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Tooling Buicks

Buick's centralized tool plant occupies three floors, employs over three hundred men and serves all production departments

BURNHAM FINNEY
Western Editor

The Buick Motor Company operates one of the most efficient tool plants in the country at its Flint, Mich., factories. Its products cover a diversified range, including jigs, fixtures, gages and cutting tools. It also rebuilds machine tools and makes special machinery for use in Buick's manufacturing operations.

Identified as Factory 29, the tool plant is a centralized unit serving all of the Buick production departments. It is probably the largest tool plant in the automobile industry. Some conception of the scope of its activities may be gained from the fact that it handles an average of 80 orders a day or 25,000 a year. Its total business the past 12 months has consistently averaged $45,000 to $50,000 a month. In connection with the tooling program for the 1937 series of Buick passenger cars, it handled 3,375 individual tool orders.

The tool plant occupies a three-story building containing 57,600 sq.ft. of floor space. It is equipped with 330 individual machines, exclusive of the heat-treating apparatus, with an original value of $700,000. In the last year new machinery costing $90,000 has been purchased—and that is a lot of money for any tool room or tool plant to spend in a single year for modernization. Adjacent to the main building is a separate structure housing the heat treating, sand blasting and welding operations (3,400 sq.ft.) and the tool steel storage and cutoff room (2,240 sq.ft.).

There are two manufacturing divisions in the tool plant; the small tool and gage division, and the jigs, fixtures and special machinery division. Work is specialized in that each of the various important machining operations, such as milling or grinding, is segregated in a separate department. The gage department is the only exception. It contains all types of equipment necessary in building gages. On account of this grouping of the work, employees mostly are men highly skilled and specializing in some particular branch of tool making rather than all-around toolmakers. The exception, again, is in the gage department, where men of versatility and wide experience are required.

Employment Stabilized

It has long been the misfortune of the toolmaking industry to have periods of rush business followed by slack or idle periods. This has been particularly true in the automobile industry, where overtime operations are necessary during the three or four months preceding the introduction of new models and completion of tooling programs brings natural letdowns. At Buick notable progress has been made in leveling off the employment peaks and taking out the valleys. Between tooling programs the men in the tool plant are kept busy making perishable tools, gages and machine tool parts, and rebuilding machinery. They also are assigned any available machine shop work. The result is that employment in the last year has fluctuated only 8 per cent. The top number of men on the payrolls was 330 and the low number 304.

Incidentally Buick's toolmakers are no youngsters. While a few of them have as little as one year of service, some have been employed continuously for 26 years, and the average length of time is 10 years. The average age of the men is 41 years. This seems to confirm the saying around Flint that "Buick is a good place to work." The tool plant, like other divisions of the Buick company, has a number of apprentices whose program will be described later in this article.

No work is done by the tool plant unless a general tool order is issued for it by the master mechanic's divi-

Dies are assembled in the erecting department

sion. Before such order is given, a request for an estimate, accompanied by a complete set of drawings, is sent to the tool plant so that everybody concerned will know what the labor and material for the job will cost. If the expenditure is warranted, the general tool order is sent to the tool plant. Along with it go three complete sets of blue prints.

The order then is matched with the estimate sheet and a foreman's shop order issued (each of the two divisions of the tool plant has a general foreman in charge). One set of blue prints is cut up, with only one detail on each piece of blue print, on the back of which is stamped the order number, tool number, pieces required, date and the department to which it is to be sent. The cut-up blue prints, with one set of prints intact, goes to the division which will do the work.

After the blue print and order are received by the division head, an order clerk requisitions the material for the complete job. The material is cut to required lengths and sizes and delivered to a central distribution point in that division where it is routed to the department performing the first operation. Work is inspected after each operation and routed to the next department by the foreman, who has a clerk fill out a tool transfer ticket. One copy of the ticket goes to the central file for that division and the information from it is posted on the follow-up card, which is on the back of the tool shop order. A second copy accompanies the work to the next department. When the work is ready to leave the second department and a new tool transfer ticket is made out, the old one is destroyed.

Estimates of tool costs are based on past experience with similar jobs, a knowledge of available equipment, and a thorough understanding of the work to be done. Material and labor costs are estimated in detail and are filed by tool numbers until the general tool orders are received. They are then marked with the order number and filed in a live estimate file. These sheets are posted daily with the actual labor as indicated by the job time tickets. This method furnishes an accurate record of all labor department by department.

In case the labor cost of a job exceeds the estimate, the foreman is notified by means of a control ticket, issued by the posting clerk, showing the additional time required to complete the job and the reason for the over-run. This ticket is filled in by the general foreman of the division and eventually goes to the tool plant superintendent. Careful estimating and close supervision keep over-runs down to a minimum. When an order is completed, the general tool order is attached to the estimate sheet and filed by tool number for future reference in estimating.

Keeping to Schedule

In each department is a stock bench to which work is delivered as it arrives from other departments. The benches are divided by small metal partitions into days of the week. If a fixture "in process" comes in on a Wednesday, it is placed in the section marked for that day and by the following Wednesday it, as well as all other work in that section, must be completed and on its way to the next department. In this manner work is prevented from staying in any department longer than a week, and the sooner it is finished the better.

The only variation from this procedure is in the general grinding department. When work reaches that department, it is almost completed. To prevent delays, the receiving bench is marked off into sections corresponding to days of the month. It is a tool plant rule that all work must be completed, inspected and delivered within 30 days after an order is issued. Hence work as it arrives at the general grinding department is put in the compartment for the day of the month designated on the work order. Before that day arrives, the work must be completed

Divided table used for keeping work within its one-week time limit

and delivered to a bench man to be assembled. After completion, the work is marked for future identification, is inspected and an O.K. in-inspection report issued so that shipment can be made to the department and factory ordering it.

All of the bench men in the gage department fall in the classification of gagemakers rather than toolmakers. While the latter are highly skilled and can do all-around work, the gagemakers (about 15 in number) work to much closer limits. Where the toolmaker may do a job within one-thousandth, the gagemakers hold it to a tenth of a thousandth. They perform such operations as honing, lapping and assembling gages, and etching measurement lines.

A centralized tool crib is located on each of the three floors of the tool plant. Over 3000 milling cutters are kept in the crib on the third floor. This large stock is available because almost every job takes a cutter with a special angle, width or length. Each angle and each thickness is marked and the cutters stored in a designated spot so that machine operators are not delayed in securing the right cutter.

Outside each crib and also inside are boards containing wooden samples of the various cutting tool angles with the numbers designated. An operator can order the type of tool, after looking at the sample to make sure it is what he wants, and

Each time a diamond is reset its loss in weight is recorded

the crib hand can look at his sample board to avoid mistakes in issuing tools. This orderly process makes it unnecessary for an operator to keep a large supply of cutting tools in his tool box or at his machine and likewise helps reduce inventories.

When drilling and tapping, bench men usually need a tap drill, body drill, counterbore, and starting and bottoming taps. For the convenience of these men all these tools are kept in one block and labeled under the tap size in the tool cribs. They are checked out of the cribs to the men on demand.

For the building of jigs and fixtures, bench work is divided into six bays with eight workmen in each bay. About half of these men are highly skilled and the others are helpers who gradually acquire greater knowledge and experience, partly through association with the more skilled men.

Setting Diamonds

At one time each Buick factory set its own diamonds, which are used mostly for dressing grinding wheels. Recently the cost has been considerably lessened by the practice of setting diamonds in the tool plant. As it is received, each diamond is removed from its old setting, cleaned and weighed. On the holder of the new setting is stamped the weight and the diamond number. A record is made of the loss of weight from the previous setting, a card being kept for each diamond in service.

All plug gages no longer of the proper size are sent from manufacturing departments to the tool plant and are salvaged by being ground to within 0.0005 in. to 0.001 in. under the specified size, and then chromium plated, reground and lapped to size. It is estimated that the chromium plating of gages adds two to three times to their life. A special chromium plating unit has therefor been installed in the tool plant.

Gages are lapped on centers in a grinder using an aluminum disk wheel in place of an abrasive wheel. The fine abrasive compound consists of levigated aluminum mixed with sperm oil. This type of wheel does not load and removes the feathered surface on the gages caused by grinding, giving a high finish and longer wearing quality. Gages are checked with an amplifying gage against Johansson blocks.

The tool plant builds many functional gages for the testing of various automobile parts in production, such as transmissions, flywheel housings and crankcases. It also makes functional gages for foundry use, having completed one which checks entire cylinder blocks.

Circular forming tools used to be turned, hardened and polished. The present method is to turn, harden and grind them on a No. 13 Brown

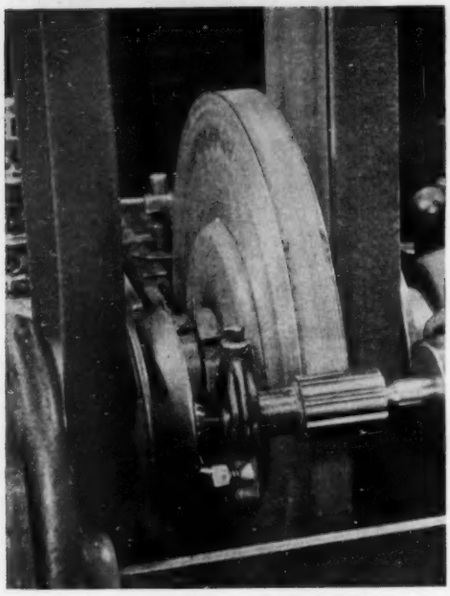
Many functional gages are built in the course of a year

& Sharpe machine specially equipped for the job. Grinding corrects any surface changes that may have occurred in the hardening process and gives the tools a much keener cutting edge. All flutes on cutting tools are ground and polished by hand. It takes several years to qualify workmen for this job.

When reamers are ordered in quantities, they are milled three at a time on Cincinnati, Brown & Sharpe and Garvin milling machines having triple-spindle heads. In forming pieces of steel or cast iron usually cut out on shapers, Buick employs in the shaper department a flame cutting machine utilizing a combination of city gas and oxygen.

Equipment in the heat-treating department consists of four oil-burning carburizing furnaces; an oil-fired forge furnace; a coal-burning forge furnace; a Nazel hammer for forge work; a gas-fired preheat hardening furnace; a high-speed, atmospherically-controlled gas hardening furnace; two lead pots; one cyanide pot; a large tool steel hardening furnace with an upper preheating chamber and a lower high-heat chamber, operating on oil; an electric tool steel hardening furnace; a large-size Homo furnace; a small and a large Lindberg furnace; and one small electric draw furnace. In the heat-treating room are two electric butt welding machines for fusing high-speed tool-steel cutting tools onto carbon steel shanks. All heat-treating furnaces are pyrometer controlled with recording instruments. About 85 per cent of all work in the tool plant passes through heat treatment.

Adjacent to heat-treating equip-



Gages are lapped on aluminum wheels

ment is a small sand blast room where the scale is cleaned off work after it is hardened. Nearby is a room with portable electric and acetylene welding machines, which are used to fabricate small fixtures and to do the usual run of tool room welding.

Materials are moved from one department to another in hand trucks divided into bins corresponding to the various departments. Three men are constantly engaged in this work, one to a truck. In addition to picking up and delivering materials, they write out the tool transfer tickets and put them with the work.

Each tool or piece of equipment produced by the tool plant is stamped or etched with the tool number and the detail number of the job. In this way Buick's manufacturing departments can identify tools and order new ones when the old ones are worn out or broken.

Apprentices are given a four-year course in toolmaking. They are required to fill out a detailed application blank pertaining to their personal history and preferably should be high school graduates with a good school record. Their shop routine is about as follows (although the schedule is somewhat flexible):

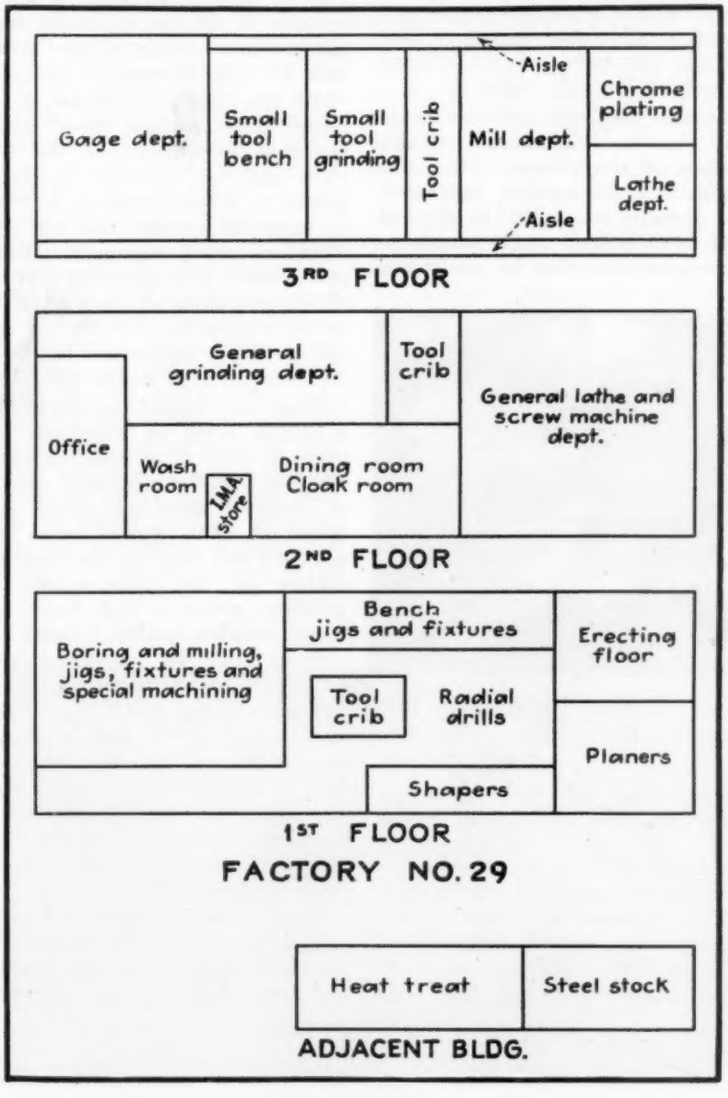
TOOL CRIB— one month
LATHE—Small tools, centering and facing, straightening, plain and taper turning— three months
SHAPER—Layout, machine operation— five months
BENCH—Small tools, layout, drill & tap assembly, small parts— two months
MILLING—Vise & fixture, dividing head— six months
LATHE—Boring, threading, chucking— four months
GRINDER—Internal, external, surface— six months
HEAT TREAT—High speed steel, carbon steel, carburizing, forging— four months
PLANER— two months
OFFICE— one month
BORING MILL—Locating & machining jigs, fixtures, gages, etc.— six months
GENERAL TOOL MAKING—Bench, scraping, filing, fitting, assembly jigs, fixtures, gages, etc.— eight months

Along with the shop work apprentices are required to take courses at the General Motors Institute of Technology in Flint in shop drawing, blue print reading, advanced shop arithmetic, shop geometry, shop trigonometry and slide rule theory and practice. These courses run from two to four hours of classwork a week. Each course, except that in advanced shop arithmetic, is for 12 weeks. In the first three months of his apprenticeship, a boy is required to purchase tools costing $20 and before the four-year course is ended, he expends $175 on his kit.

Periodically apprentices are rated on characteristics such as initiative, reliability, conduct, workmanship, accuracy, speed, attendance and punctuality. A record is kept in the tool plant office of the dates worked in various departments and of advancements in pay rates.

The tool plant has its own dining room and modern wash room and an I. M. A. (Industrial Mutual Association of Flint) store where employees can purchase tobacco, candy and other merchandise.

Factory No. 29 has three floors divided as shown with heat treat and steel stores in an adjacent building



Amplified Gaging

Standard measuring devices are made more sensitive or more versatile by combination and by ingenious applications

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The measuring equipment at the Schenectady Works of the General Electric Company has been made more sensitive or more versatile by adapting existing devices to new uses or to other machines than those for which they were originally intended. Some new devices have been created as the need for them arose.

By applying an electric gage to the "drop plug" type of tail stock of a Pratt & Whitney measuring machine, Fig. 1, the sensitivity of the machine has been increased. One one-hundred thousandth inch (0.00001 in.) is represented by approximately ¼ in. on the instrument scale. The increased sensitivity permits the measuring machine to be used as a comparator. For very accurate measurements the graduated screw of the machine is not moved—the instrument readings alone being taken as each piece is successively positioned between the anvils of the machine. The indicating instrument is applied to the movable head to avoid parallax errors in reading.

To prevent distortion of the machine the weight of the instrument—about 8 lb.—is supported by a track made of heavy sheet steel which rests on the machine base. Pressure is regulated by a spring and adjusting nut at the back end of the tailstock. The internal type of gage head is used here. The Bureau of Standards at Washington has applied an electric gage head of the external type to their Pratt & Whitney measuring machine substituting a short ram supported by flat spring members for the tailstock spindle.

Ungraduated steel tapes of proper length to measure accurately the circumference instead of the diameter of large work have been used by the General Electric Company for a number of years, (*AM*—Vol. 62, page 26). To eliminate tension variations, the device shown in Fig. 2 has been made. The tension is standard when the end of the finger is flush with the upper surface of the device. This finger is part of the left hand vertical link. For measuring the diameter of a shaft which has a keyway, a section with a pair of rolls, Fig. 3, is inserted in the tape. The formulas, Fig. 4, for the necessary computations are:

D = diameter of work

d = diameter of rolls

A = center to center distance between rolls

t = tape thickness

$$L = A + (D + t) \tan Q + \frac{360 - 2(P + Q)}{360} \pi (D + t)$$

$$P = \text{Arc sine } \frac{A}{D + d}$$

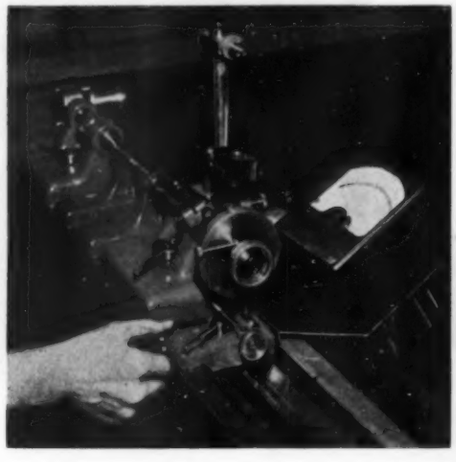
$$Q = \text{Arc cosine } \frac{D + t}{D + d}$$

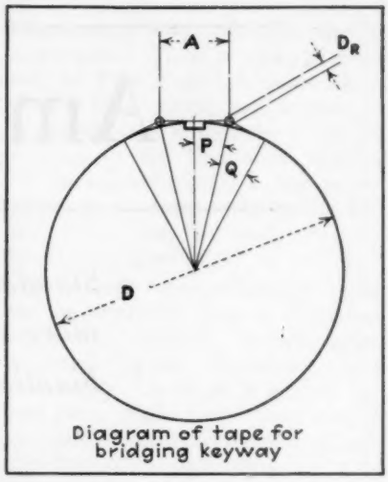
The Bausch & Lomb shop microscope is used for measuring the gap between or the overlap of the ends of a tape. The amount of gap or overlap divided by π gives the diameter deviation of the work, plus or minus, from the diameter represented by the tape.

This shop microscope is also used for checking distortion of flat test specimens on which fine, accurately spaced cross-section lines have been scribed, Fig. 5. A flat surface perpendicular to the base surface has been machined on the side of the microscope base. The microscope tube is rotated to bring its scale perpendicular to this surface. A perpendicular surface is also established on the specimen. Between this surface and the side of the microscope base, gage blocks in multiples of 0.100 in. are used to position the microscope. Thus an unlimited range of measurement is available, although the microscope scale is only 0.100 in. long. Graduated rules and gages are also checked in this manner.

To facilitate the checking of templates in which a number of radii are scribed at various center distances and tangent one to another, the graduated circular table of a Zeiss universal measuring miscroscope is used. Two straight edges accurately positioned at right angles

Fig. 1—Addition of electric gage makes sensitive comparator of Pratt & Whitney measuring machine





Figs. 2–4—Tape tension device, left, is used with roller insert to bridge keyway as indicated in other two illustrations

to each other are doweled to a ring applied to the rim of the circular table, Fig. 6. Using gage blocks the template can be moved specified distances in two directions to position the theoretical center of each radius in succession on the center of the circular table. The location of the center of the circular table having been previously established in the machine, the table is moved laterally from this center a distance equal to the radius which is being checked. By rotating the table this radius on the template is swept past the cross lines of the microscope and the error noted. Angles tangent to radii can also be checked in this set-up. This Zeiss circular table can also be adapted to a projection measuring comparator for similar and other varieties of close measurements.

For measuring contours of templates or form milling cutters where the contours are too large for the aperture of the projection comparator, the magnified theoretical contour is made in sections superimposed upon one another. Sections should overlap slightly. The successive positions of the work having been determined, the distances between positions in one or both coordinates are

Fig. 5—Shop microscope set up to measure distortion of flat specimen as indicated by scribed lines

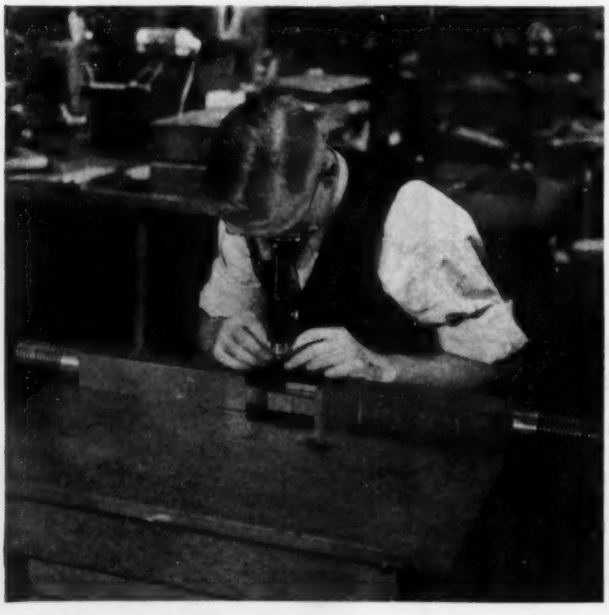
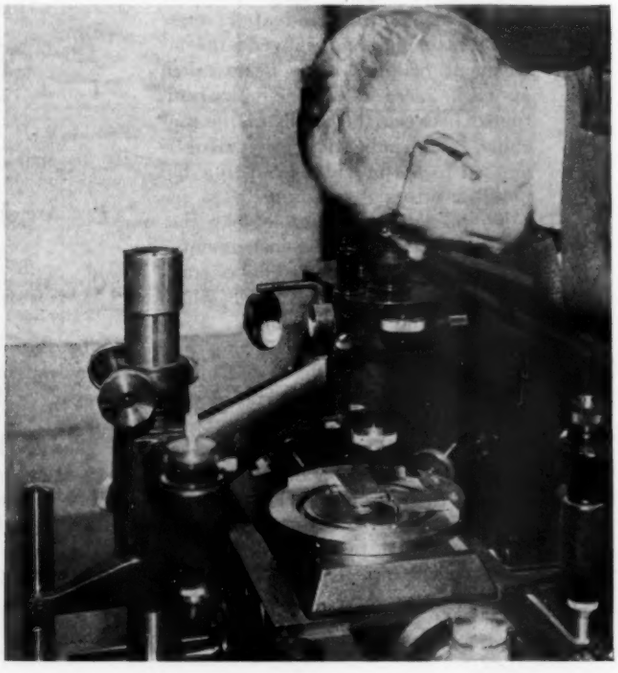


Fig. 6—Straight edges doweled to a ring on the circular microscope table locate gage blocks for positioning template



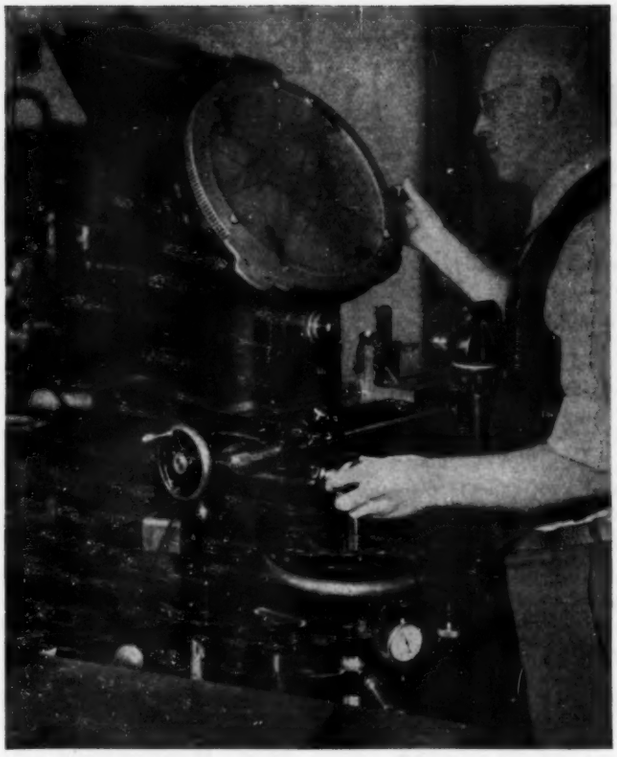


Fig. 7—Contours too large for the comparator apeture are compared section by section with theoretical contour

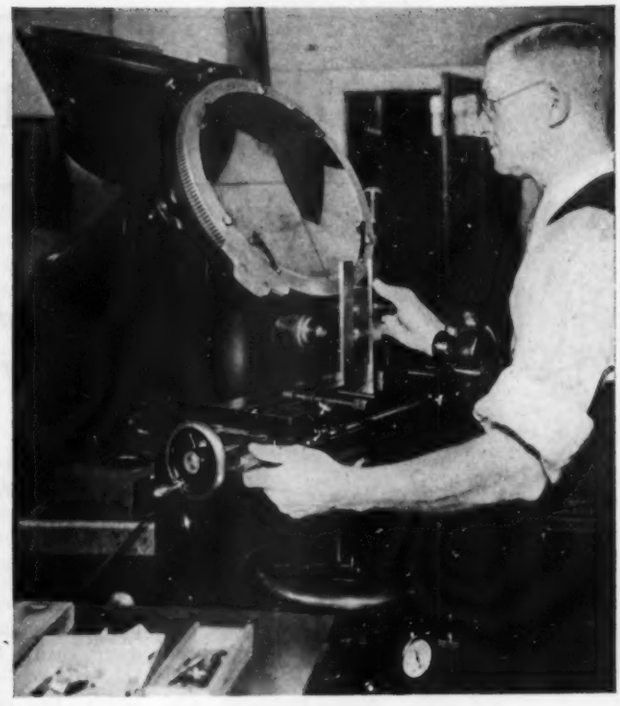


Fig. 8—Fellows cutters are checked by means of a transparent base circle disk rolling on a straight edge

Fig. 9—Phonograph needles make a direct reading trammel out of a vernier caliper

plotted. The base lines or points used in constructing the magnified theoretical outline are successively shifted through distances equal to the product of each of these coordinate distances and the magnification factor on the ground glass screen and the sections of contour accordingly drawn one over another. With the work shifted successively through the predetermined coordinate distances, all parts of the contour of the work can be checked for accuracy of outline and relation to each other, Fig. 7.

Fellows Gear Shaper cutters can be checked for accuracy of involute in a projection comparator. A transparent disk of the base circle diameter (not pitch circle diameter) for a gear of diametral pitch and number of teeth corresponding to the cutter is placed on a short mandrel in the cutter. The tooth flank of a correct cutter will remain tangent to a line representing the pressure angle for the gear when the transparent disk is rolled without slipping on a transparent straight edge, Fig. 8.

For scribing a number of different radii or measuring distances between lines where extreme accuracy is not required, the attachments to a vernier caliper shown in Fig. 9 are used. Phonograph needles are used as scriber points. Each point is positioned in the plane of the inside face of its vernier caliper jaw by its holder. This makes a direct reading trammel of the vernier caliper. Where extreme accuracy is necessary, gage blocks and the usual accessories are of course used to construct trammels.

These adaptations and improvements together with standard measuring practices permit a fuller use of equipment. Also, since more than one method of accomplishing a given check is available, emergency requirements can be filled quickly, often without tearing down another job.

Sharpening Wheels

How to select the right ones for grinding carbon, high speed and Stellite tools in the sharpening room of the average shop

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Lack of sufficient information, or plain carelessness, in selecting the wheel best suited to any tool - grinding job may result in a spoiled tool, too high a cost for resharpening, or too high production costs when the tool is put into use in the shop.

There are four principal factors affecting the choice of a grinding wheel: the characteristics of the material to be ground, the amount of stock to be removed, the area of contact between wheel and tool, and the type of grinding machine.

Well designed grinding wheels have five characteristics, all of which can be varied so as to produce a wheel which is well adapted to the particular job to which it will be put.

These variable wheel characteristics are:

1—*Type of abrasive.* For sharpening tools of carbon steel, high speed steel and the like, all of which are tough and of high tensile strength, aluminum oxide abrasives are best.

A wide range of physical characteristics can be obtained in aluminum oxide abrasive by varying the process of manufacture.

The "regular" aluminum oxide is very tough. It has strength to resist the high grinding resistance of steel, without breaking down too soon.

However, for tools of less tensile strength, or when there is danger of burning or drawing the temper of the tool's cutting edge, it is desirable to use an abrasive with weaker crystals which will fracture more readily and so constantly present new, keen cutting edges to the work, resulting in cooler cutting. By varying the manufacturing methods, it is possible to produce aluminum oxide with weaker, more easily fractured crystals. In this article the weaker abrasives are called "free cutting."

2—*Size of grain.* The size of abrasive grains is indicated by numerals showing the number of meshes per linear inch of screen. It is important that the grains be uniform in size. The undersize grains in a wheel will not do their fair share of the work—while oversize grains will scratch and mar the surface. In general, use finer grains for fine finish and close accuracy, coarse grains for fast cutting. Too fine a grain is apt to burn the tool. Coarse grains are best for soft, ductile materials and fine sizes for hard and brittle materials. Most tool sharpening jobs call for medium or fine grains.

3—*Grade.* The "grade" of a wheel indicates the strength with which the bond holds the grains in place. If the bond is strong enough to hold the grains against the considerable force which is tending to pry them loose, the wheel is said to be of "hard" grade. If only a slight force will tear the grains from the bond the wheel is said to be of "soft" grade.

In general, select hard grades for soft materials and vice versa. The smaller the area of contact between wheel and work, the harder the grade should be. The higher the ratio of work speed to wheel speed, the harder the grade—and vice versa. The better the condition of the grinding machine and the less the vibration, the softer the wheel can be. The grade should be soft enough not to draw the temper of the tool, yet

hard enough so that it will not wear too rapidly and so fail to produce a sharp edge.

In this article, to show the exact degree of grade, the markings as used on Norton wheels are given. They are grouped as follows: very soft, E, F, G; soft, H, I, J, K; medium, L, M, N, O; hard, P, Q, R, S; very hard, T, U, W, Z.

4—*Structure.* The grinding action of a wheel is affected greatly by the amount of space between the abrasive grains. By varying the structure the number of abrasive grains per unit arear of wheel face can be increased or decreased. The number and size of the voids between grains are also affected.

Grinding of tools and cutters is, with a few exceptions, best done with wheels of medium grain spacing.

The structure numbers used in this article are those used in marking Norton wheels. They are: close spacing, 0, 1, 2, 3; medium spacing, 4, 5, 6; and wide spacing, 7, 8, 9, 10, 11, 12.

5—*Type of bond.* Most of the wheels recommended for tool grinding are made with a special vitrified bond which gives a wheel of exceptionally uniform and stable strength and grain arrangement throughout. Wheels of this "special" bond cut more freely and give longer life than do those made with the regular vitrified bond.

For some tool grinding operations such as cutting off of drills, or where great accuracy and finish are required, shellac, resinoid or rubber bonded wheels are used. For manufacturing reasons, silicate bond is used for very large solid wheels.

In the following descriptions of specific tool and cutter sharpening jobs it is assumed that for dry grinding a peripheral speed of from 4,500 to 6,000 surface feet per minute will be used, and for wet grinding a speed of from 5,000 to 6,000 S.F.P.M.

Work speed cannot be specified exactly because it depends upon many variables such as the material being ground, size of tool, finish desired and type of machine used. It is only by trial that the best work speed can be determined.

Drills

While small drills are frequently sharpened by hand, machine grinding is recommended for drills larger than three-eighths of an inch. When properly machine ground, a drill can be expected to cut faster, last longer and produce more accurate holes than if ground by hand. High speed steel drills can be ground successfully either wet or dry.

In sharpening drills it is of great importance to keep the cutting lips of equal length, and at equal angles, usually 59 degrees, to the axis. Otherwise the point of the drill will be off-center and the drilled hole will be oversize. As a result the drill is very apt to fail, as the lip having the larger angle is doing all the work.

For pointing drills on machines with cup wheels, use a free cutting aluminum oxide wheel, 46 grain, medium structure and medium grade special vitrified bond. Hand pointing is best done with regular aluminum oxide, 60 grain, medium structure, and medium grade special vitrified bond. The smallest wire sizes are pointed on a rubber bond wheel of regular aluminum oxide, 60 grain.

Lip Clearance

One of the most important requirements in drill grinding is proper lip clearance or so-called "backing off" of the cutting edges. Lack of clearance is a principal cause of drill failures, for an improperly cleared drill will not stand heavy cuts.

Point thinning is the grinding of a short groove on each side of the web of the drill at the point, thus reducing the length of the flat between the cutting edges. Proper pointing decreases the power needed to feed the drill, enables it to cut more freely, lessens the tendency to split the point and produces better work. The point should be thinned to about one-half the web thickness. For point thinning use a rounded face wheel of regular aluminum oxide, 60 grain, medium structure and medium grade special vitrified bond.

Grinding should commence on the curved portion of the flute and the drill rotated by hand until the proper point is obtained.

Broken or "burned" drills may be reclaimed by cutting off the ends with a thin resinoid bonded cutting-off wheel of regular aluminum oxide, 60 grain, wide structure and hard grade. Such a wheel will not burn or draw the temper of the drill.

Sharpening milling cutters requires a free, cool cutting wheel to prevent drawing the temper of the cutting edge. Light cuts are essential. Experience soon enables one to determine the rate of feed best adapted. Dry grinding is generally used.

High speed steel and Stellite cutters, plain and inserted tooth types, are usually ground on the rim of cup shaped wheels of free cutting aluminum oxide abrasive, 46 grain, medium structure and soft grade special vitrified bond. If the wheel face or periphery is used, the grade may be one degree harder.

For rotary gear cutters use wheels of free cutting aluminum oxide abrasive, either 46 grain, soft grade and medium structure, or 60 grain somewhat softer grade and medium structure—both of a special vitrified bond.

In grinding milling cutters it is always best to revolve the wheel toward the cutting edge as this is less likely to burr or burn the edge. However, close attention is needed in grinding inserted tooth milling cutters to insure against the tooth being carried into the wheel. The operator must be careful to hold the cutter tooth firmly against the tooth rest.

If the grinding is done by revolving the wheel off the cutting edge, the grinding should be followed by stoning to remove the slight burr usually left.

To offset the wear of the grinding wheel it is well to grind around the cutter, then revolve it 180 degrees, start anew on a tooth just opposite the original starting point and take another cut all the way around. By repeating this method and taking light cuts, the wheel wear is equalized and the cutter is kept cylindrical. Under favorable conditions the

TYPE OF WHEEL FOR TOOL SHARPENING JOBS

TOOL	OPERATION	ABRASIVE (Aluminum Oxide)	GRAIN SIZE	GRADE STRENGTH OF BOND	STRUCTURE SPACING OF GRAIN	BOND
Broaches	Sharpening	Free cutting	46	Soft (K)	Medium (5)	Vitrified (special)
Dies (threading)	Chamfering on cone wheel	Regular	80	Hard (Q)	Medium (5)	Vitrified (special)
Drills	"Backing off" (clearance grinding)	Free cutting	46	Medium (L or M)	Medium (5)	Vitrified (special)
	Pointing on machines, cup wheels	Free cutting	46	Medium (L or M)	Medium (5)	Vitrified (special)
	Hand pointing	Regular	60	Medium (M)	Medium (5)	Vitrified (special)
	Pointing smallest wire sizes	Regular	60			Rubber
	Point thinning on round face wheel	Regular	60	Medium (M)	Medium (5)	Vitrified (special)
	Cutting off ends	Regular	60	Hard (P)	Wide (7)	Resinoid
Gear Cutters (rotary)	Sharpening	Free cutting	46	Soft (J)	Medium (5)	Vitrified (special)
	Sharpening	Free cutting	60	Soft (I)	Wide (8)	Vitrified (special)
Hobs	Sharpening, saucer shaped wheel	Regular and free cutting	60	Soft (J)	Medium (5)	Vitrified (special)
Lathe and planer tools, (carbon and high speed steel)	Light off-hand roughing	Regular	36	Medium (O)	Medium (5)	Vitrified (special)
	Light off-hand finishing	Regular	60	Medium (N)	Medium (5)	Vitrified (special)
	Heavy off-hand	Regular	30	Medium (O)	Medium (5)	Vitrified (special)
	Heavy (large wheels)	Regular	24	Hard (P)		Silicate
	Automatic (cup wheels)	Regular	24	Medium (M)	Medium (5)	Vitrified (special)
	Automatic (straight wheels)	Regular	24	Medium (M)	Medium (5)	Vitrified (special)
Milling Cutters (high speed steel or Stellite)	Sharpening on rim of cup or dish wheel	Free cutting	46	Soft (J, K)	Medium (5)	Vitrified (special)
Reamers	Backing off with cup wheels	Free cutting	46	Soft (K, L)	Medium (5)	Vitrified (special)
	Cutting back flutes	Free cutting	46	Soft (J)	Medium (5)	Vitrified (special)
Reamer blades	Surfacing high speed steel inserted blades with face of wheel	Free cutting	46	Soft (H)	Wide (8)	Vitrified (special)
	Same, in vertical spindle machine using rim of cup wheel	Free cutting	46	Very soft (G)	Wide (8)	Vitrified (special)
Saws (metal cutting)	Gumming	Regular	30	Medium (N)	Close (3)	Shellac
Saws	Gumming (fine teeth)	Regular	60	Medium (O)	Medium (5)	Shellac, (special)
	Same, very thin saws	Regular	80	Soft (J)	Medium (6)	Vitrified (special)
Taps	Clearance grinding	Free cutting	80	Soft (J)	Medium (6)	Vitrified (special)
	Grind in flutes on tool grinder with face of wheel shaped to flute	Free cutting	46	Medium (L)	Medium (5)	Vitrified (special)
Thread chasers	Surfacing	Free cutting	46	Soft (J)	Medium (5)	Vitrified (special)
	Grinding throats	Regular	60	Medium (M)	Medium (4)	Shellac

grinding wheel may remove 0.003 in. or 0.004 in. of stock, but the average cut should not remove more than 0.002 in. followed by a light finishing cut. Ordinarily grinding the cutter once around will put it in good condition if not too badly worn.

Hobs

Hobs or multiple cutters must be ground carefully if accurately cut gears are to be produced. A well conditioned hob must have an accurate profile, proper lead, regularly gashed flutes and uniform clearance on the form. Hobs are ground successfully with saucer shaped wheels of either regular or free cutting aluminum oxide, 60 grain, medium structure, special vitrified bond of soft grade. For large formed hobs use wheels of free cutting aluminum oxide, 46 grain, wide structure, soft grade special vitrified bond.

Reamers

For grinding the clearance of reamers, cup wheels of free cutting aluminum oxide, 46 grain, medium structure, soft grade special vitrified bond are recommended. Sometimes the clearance is ground cylindrically, with a straight wheel, where the land is very slight.

For surfacing high speed steel inserted reamer blades with the face of the wheel use wheels of free cutting aluminum oxide, 46 grain, wide structure, soft grade special vitrified bond. The same operation on a vertical spindle machine using the rim of a cup wheel, calls for a very soft (G) grade bond—abrasive and structure the same.

Taps

Many taps are discarded that could have been easily restored to good condition by regrinding. The two important factors are radial relief and uniform height of lands. For clearance grinding use free cutting aluminum oxide, 80 grain, medium structure, soft grade special vitrified bond.

When the cutting edges of the teeth become dull, nicked or burred, it is necessary to grind in the flutes. This can be done on a tool and cutter grinder with a wheel of free cutting aluminum oxide, 46 grain, medium structure and medium grade special vitrified bond. The face of the wheel should be shaped to conform to the flute of the tap, generally an arc of a circle. Extreme caution must be exercised not to draw the temper of the steel. For this reason light cuts are recommended.

Lathe and Planer Tools

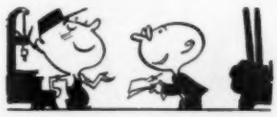
Lathe and planer tools are ground either free hand or by machine grinding methods. The latter is best, insuring correct grinding angles with less waste of stock and a longer lasting tool. Except for tools tipped with cemented tungsten carbide, regular aluminum oxide wheels are used. The grain sizes, structures, grades and bonds to be used for the various operations are given in the accompanying table.

If wheels of the characteristics given in this table are used, in accordance with the suggestions given above, the cost of resharpening tools will be kept at a minimum consistent with high quality of work.

Talking Shop

Getting the Shop's O.K.

One of the early fallacies of scientific management, that all the brains of a plant were (or should be) in the planning department, has been pretty thoroughly exploded. The designing department of most successful plants consult the shop as to designs of both product and tools, and particularly as to operations to be performed. In nearly all cases the foreman of the department in which a tool is to be used is consulted as to tools and fix-



tures before final designs are drawn. In many shops valuable suggestions are secured from the men who are to use the tools. But whether the original design is changed or not the foreman or operator who has put his O.K. on a design uses every effort to make it a success. The same tool, sent to them without their approval, might easily develop a number of faults.

Simple Machines Again

In spite of frequent suggestions and requests from machine tool users there is little definite movement toward simplified machines. Instead the tendency seems to be toward more and more complications in the way of controls and attachments. These all have their place but many feel that there is a real market for simpler machines in shops where the newer devices are not necessary.

As an example of the market for simpler equipment is a large plant with a reputation for economical manufacture that is still using a large number of one type of machine that are from 30 to 40 years old. The machines are overhauled at regular intervals so that bearings and alignment are always in good condition. It is not a question of objecting to spending money for new equipment as much is being bought. But until the modern machines for this kind of work are simplified they will continue to rebuild and to use the machines built in the last century.

Fly Cutter Milling

Diamond boring, or the use of single-point fly cutters, has made a great comeback as a machine operation. Old time toolmakers and shopmen have always recognized its value where round holes are necessary. The single point tool generates a circle just as gear tooth forms are generated in some types of machines. One large manufacturer is also using the single point principle in milling. The work is a non-ferrous casting and the fly cutter

faces flat, mating surfaces as the work is passed in front of the cutter. By grinding the corner of the cutter with a slight radius it leaves a beautiful finish and a surface that is as nearly flat as we are likely to get.

Mistakes Pay – Sometimes

In one very successful shop of our acquaintance it is part of the procedure to estimate on the cost of jigs and fixtures as well as on the product itself. And this in spite of the fact that some fixtures are necessary for interchangeability, whether they save money or not. "We generally keep within our estimates," said the engineer in charge. "But unless we make a mistake once in a while we know

we are playing safe by always estimating too high. The man who always comes under his estimate isn't the safest man for the job. It pays to make a mistake once in a while. It keeps us on our toes."

Personnel First

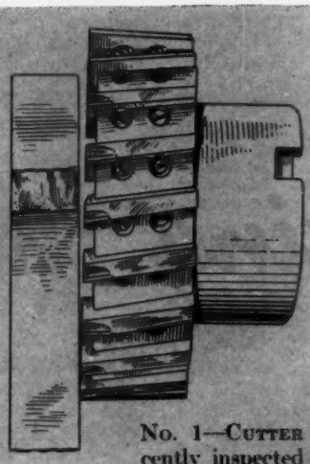
Some shop managers, especially those who have not come up through the shop, place too much dependence on machine equipment and not enough on the men and women who operate it. In a large plant, recently visited, with several thousand employees and millions in machine equipment, the production manager said: "We have a huge investment in machines but if I had to choose between

losing all my equipment or my personnel I'd keep the personnel. Without a good personnel no machinery can earn its keep."

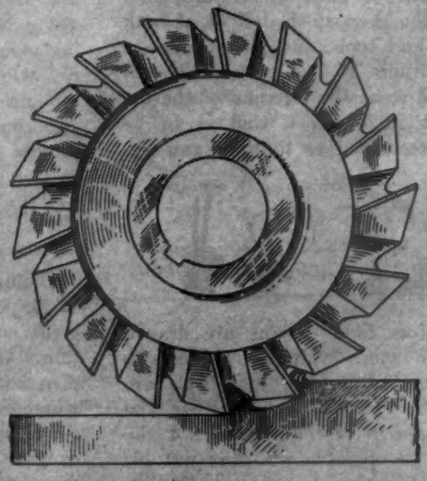
Cutter Enemies

G stands for grinder when you are looking for a G-man to banish the foes of tool life; for the tool grinder holds most of the clews that lead to an end of violations of good cutter practice. A few of the offenders lie beyond his control, and it's up to management to apprehend these. So look over the rogues' gallery on these pages and see if you recognize any of the outlaws as frequenters of your plant

JOHN HAYDOCK
Managing Editor

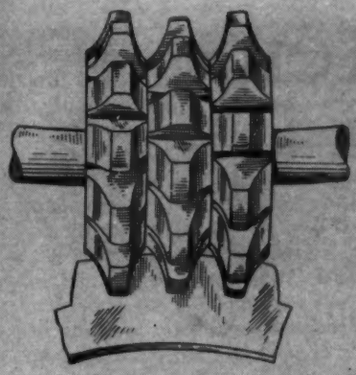


No. 1—Cutter Runout. A recently inspected face milling job showed only four out of fourteen teeth cutting. Feed per revolution was 0.020 in. If all the teeth had been cutting this could have been increased to 0.098 in.



No. 2—Insufficient Chip Clearance. With nowhere to go, chips clog the cutter, increase the power required and mar the finish. Chip cloggage can stall a machine otherwise amply powered to complete the cut.

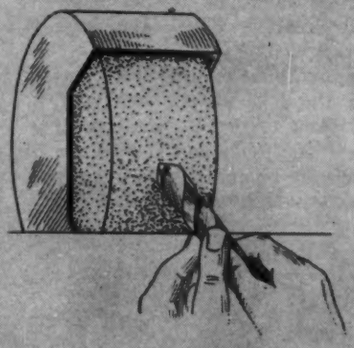
No. 3—Dullness. Don't wait for the edges to burn before changing the cutter. Look for the first sign of dullness or anticipate it through experience on the job. Broken edges mean excess grinding time and waste of high-speed steel.



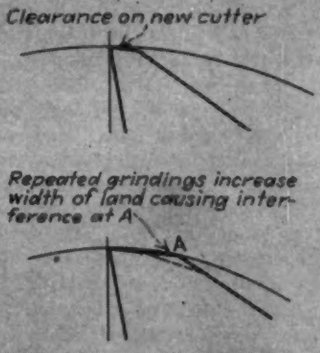
No. 4—Eccentric Arbors and Spindles. These, too, put all the work on a few teeth. When the overworked teeth dull, all of them must be resharpened. Result: more frequent grinds and shorter life.

No. 5—Battered Tangs and Tapers. This miscreant not only throws cutters and drills off center but also injures the machine in which they are used. Then an expensive repair job is in order to rebore the taper and relocate the key slot.

No. 6—Old Age. Don't expect a 1926 tool to do a 1936 job. Metallurgical progress has been too fast for decrepit tools to meet the modern tempo. It's poor economy to assign an old cutter to a tough job even if it hasn't been used.

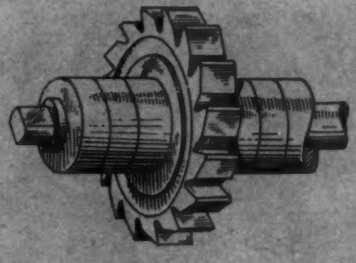


No. 7—Hand Grinding. Tests have proved that the toolmaker who could gage to thousandths by eye is either dead or a liar or both. Machine ground tools multiply the service delivered by many fold. Where possible use a positively guided tool grinder.



No. 8—Improper Clearance Angles. The cutting edge should have maximum support. As the cutter is reground and the land increases, use a secondary clearance to keep the cutting angle low. This is especially important for cutters having coarse teeth.

No. 9—Use on Wrong Material. Don't let cutters used for brass, monel metal or aluminum mix with those used for steel. Their cutting edges are ground differently—or should be. One set of grinding angles can't give good results for both ferrous and non-ferrous materials.



No. 10—Driving with Spacing Collars. Your cutters have keyways; so have your arbors. Use them. The friction drive of a collar will slip under heavy load and injure the tool. It doesn't take long to put in a key.

No. 11—Non-radial Grinding. Form cutters lose their proper profiles if they're not ground radial. That means inaccuracy in the cut, especially fatal for hobs. The exception is for tools expressly made to be ground to a given rake angle.

No. 12—Careless Handling. Felt lined shelves will do no good if keen edged tools are thrown on top of each other.

Tool Room System

How cutting tools, jigs and fixtures are stored, handled, issued and maintained in representative plants, big and little

Tool Cribs

In the days of the small shop the tools were kept in the side of the toolroom nearest the rest of the shop. Tool storage was in homemade racks, or shelves or bins. Since these were generally of wood, because steel furniture was unknown, the tools were only damaged by contact with each other, not by the shelves. Apprentice boys usually gave out the tools, with or without check, although the brass check is about as old as the tool crib itself. Sometimes an old toolmaker presided over the tool crib as a sort of semi-pensioner. There was an advantage in having an attendant who knew what the tools were and one who could readily detect damage or dullness when they were returned.

With the growth of shops into large departments, tool cribs were, of necessity, placed in each section, to be easy of access and to prevent loss of time in getting tools to the job. Efficient output depends on keeping machines at work, and almost anything that prevents idle time of expensive equipment is justifiable. But mere activity is not enough. The machine must work efficiently, which means that every tooth of a milling cutter must do its share, which doesn't always happen. Where the cutter grinding is done in the tool crib, as is sometimes the case, this is a point to be considered.

Tool crib arrangement depends on the kind of tools, the size of the plant and the ideas of those in charge. Racks that hold taps, reamers and boring bars in an inclined position so that they can be seen readily are very common. Some prefer to store taps vertically with their shanks in holes in boards or shelves. In either case the main thing is to prevent damage to the teeth, and to provide easy access. Blocks which carry the tap and the various drills used in connection with it, are favored in some places. The drills, usually included, drill the tap size and the body size. Occasionally a drill or counterbore for a filister head, is included.

Storage of micrometers, gages of various kinds, portable tools such as air or electric drills, collets and other chucks varies widely as to method. Where drill rod is used to a considerable extent, it is kept in the tool cribs in suitable bins or racks. In some plants micrometers are stored flat, in shelves or compartments. This makes a compact storage arrangement and one that completely protects them from injury. It seems better than the usual rack, or the practice of hanging them on a board.

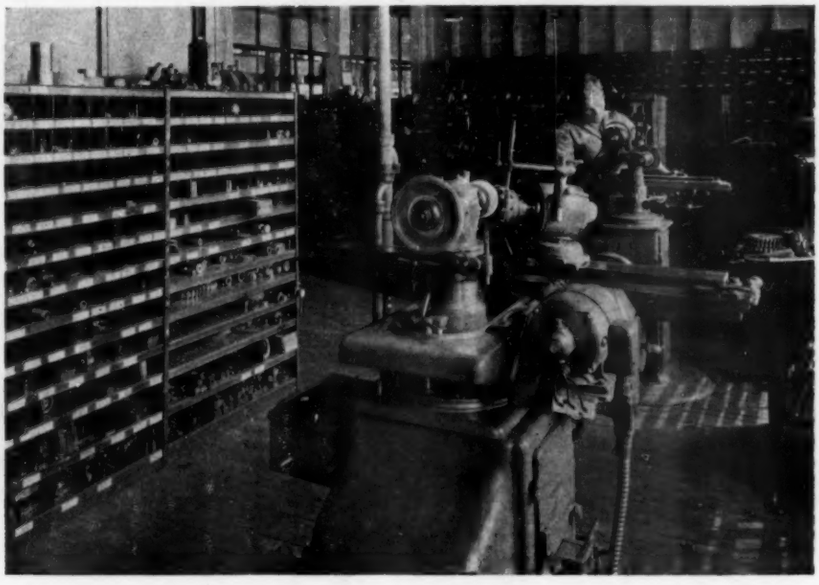
In one very well arranged tool crib most of the shelving and racks are of steel, but wooden linings protect the cutting edges of the tools. The inclined racks in the center are mounted on substantial double swiveling casters, instead of being fastened to the floor. This permits their being easily moved so that the floor may be either swept or scrubbed. Incidentally the cleaning of the floor is almost a ritual in this plant. The casters also make it easy to rearrange the rack arrangement should it seem desirable, or to move the tool crib location with a minimum of labor.

Milling cutters are held on pins through the hole in the hub, and care is taken to prevent damage of any kind. The racks and shelves are white and are repainted with a spray gun whenever necessary.

Keeping Track of Tools

One of the earliest methods of keeping track of small tools and fixtures taken from the tool crib and used in the shop was by means of metal checks. These checks were usually of brass and bore a number

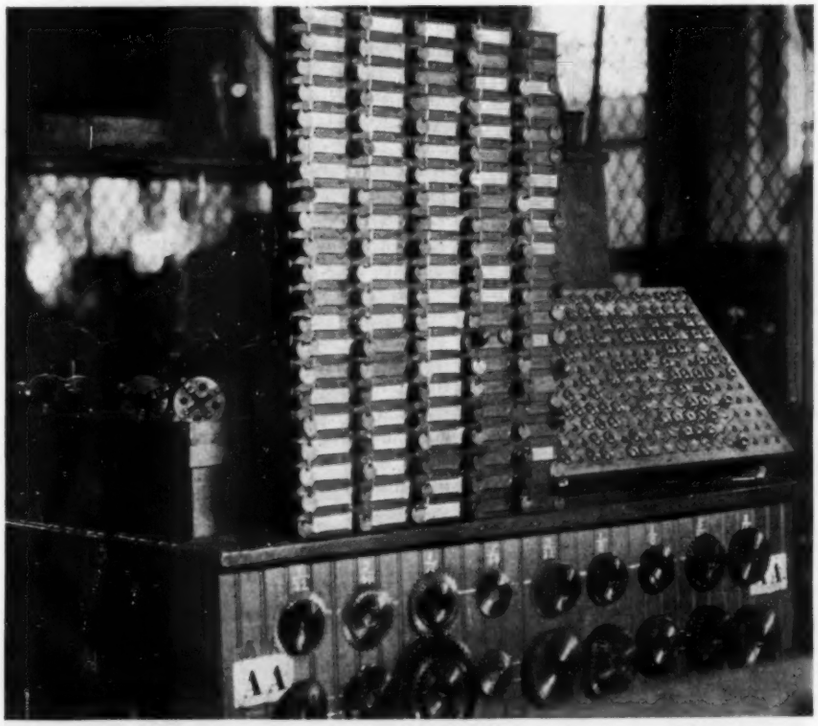
A Norton tool crib showing cutter grinders



to designate the worker. It was probably the first use of numbers for names, which has been the cause of much controversy. The system is still widely used.

In most shops the men carry the brass tags on a key ring, either in a pocket or fastened to the suspender. They leave a check for each tool drawn out, the check being placed on a hook beside or below the space in which the tool is kept, or laid in the space itself.

In one shop, the checks are kept in the tool crib on a board that is plainly numbered and kept in a convenient place. The workman gives his number and tells the crib attendant the tool wanted. One of his checks is then put where it will show who has the missing tool. It is claimed that there is less trouble from lost checks by using this system.



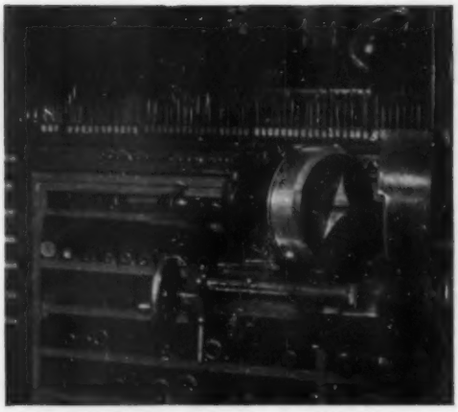
Collets and tool checks in a Pratt & Whitney crib

There are also several systems in which paper slips are used instead of brass checks. These slips are frequently made in triplicate. One copy is left at the tool crib and filed, as an order for the tool. It can be filed either under the man's name or in a list of tools. One copy goes to the engineering department and shows how frequently or how seldom a tool is used. The third copy is retained by the worker as a reminder that he is charged with the tool in question.

On returning the tool to the crib the slip left on deposit is returned to the workman, and usually both this and the one he retained are destroyed. The one sent to the engineering department is kept.

In addition to keeping track of the location of tools some shops keep a record of their performance. This is kept on cards, usually in the tool crib. It shows the date of purchase, sometimes the cost, and any repairs that are made. Some may show the number of sharpenings or the number of pieces machined, both between grinds and as a total.

When records are kept of such details there is usually a tendency to increase the amount of paper work to the point where it becomes a burden that is not always justified. It is frequently cheaper to be a little less efficient than to pay for the small savings at the upper end of the efficiency scale. One large shop in which many small drills were used gave up the method of checking them out of the tool crib separately. The operator was given a dozen drills at once, the theory being that it was cheaper to break or lose half the drills than to have the work interrupted by not having new drills always at hand.



Pratt & Whitney drilling department crib

Tool Grinding

Tool grinding practice has come a long way since the days when every machinist ground the tools he was to use on the lathe, planer, shaper or other machine. Drills were almost always ground by hand although a few pioneers like Sellers and the Washburn Shops of the Worcester Polytechnic Institute, began to use and supply drill grinding machines many years ago. Drill grinding has in fact lagged behind the grinding of other small tools, and there are still many shops where some drills at least are ground by hand.

Hand grinding in otherwise progressive shops is frequently done because of the lack of proper equipment. Some shops grind small drills by hand and those over ½-in., by machine. A few now grind all drills, both large and small, by machine, but these are the exceptions. One large plant grinds all drills over ⅛-in. by machine, but has found hand grinding more satisfactory for smaller drills. While some men become quite expert in grinding the points of drills, it is a more complicated operation than many realize, and few hand ground drills have either proper clearance at all points, or even lengths and angles on the lips. Oversize holes are common with hand ground drills. As one drill expert puts it—the average of the poorest drills resharpened by machine is better than the average of the best resharpened by hand.

Policies or systems regarding tool grinding vary widely in different shops. Intermittent use or constant flow of work affects the decision as to the method of grinding to be used. On intermittent use, where work is done in comparatively small lots, it is customary to examine tools at the end of a run (assuming they

Bullard's tool grinders are equipped with exhausts

have not shown signs of dulling during use) and have them sharpened if it seems necessary. In some shops, however, it is considered good insurance against trouble in the next run to grind all tools before they go back to the tool crib. They are then ready for the next job with a reasonable insurance against trouble.

In mass production work, where tools are on the same job day after day, it is customary in some plants to regrind after a given number of pieces have been machined. This is done before the tool normally shows signs of distress. In other shops this practice is not followed and there is a period of inefficiency when the tool is dulling, taking too much power and affecting both the finish and the output.

Few plants, outside of such large productions as automobiles keep machines constantly on one set-up. In some shops where tools are changed after a long run, the condition of the cutting edges is judged by an examination of the last piece, or pieces of work. If these are rougher than they should be, the tools are ground. This applies to punches and dies as well as other tools. Some shops also make it a practice to wire one or more of the last pieces to the tools. This helps in picking out the proper tools for a job, in addition to the tool number and location.

Most large shops have a tool grinding department to which cutters, boring bars, drills, broaches and the like go for sharpening before being put back on the tool crib shelves. There are, however, notable exceptions, even in the same plants. While the general run of tools go to the central department for grinding, tools that are used in one department only never leave it. Gear cutters, for example, are ground in the gear cutting department and are kept in a crib convenient to the gear cutting machines. The same is sometimes true of broaches, tools for jig-borers and the like. Master cams or master gears, for some work, are stored beside the machines on which they are used.

Drills are frequently ground in the drilling department in a small crib or section devoted to this work. The object is to prevent loss of time in getting drills and idle time of machines, waiting for cutting tools.

A source of loss that is not always appreciated is in the partial use of milling cutters, due to the work being done by only a few teeth. A recent survey of a number of shops revealed the fact that few milling cutters were utilizing all their teeth. Even in some shops considered to be good, not over 25 per cent of the teeth were actually cutting metal.

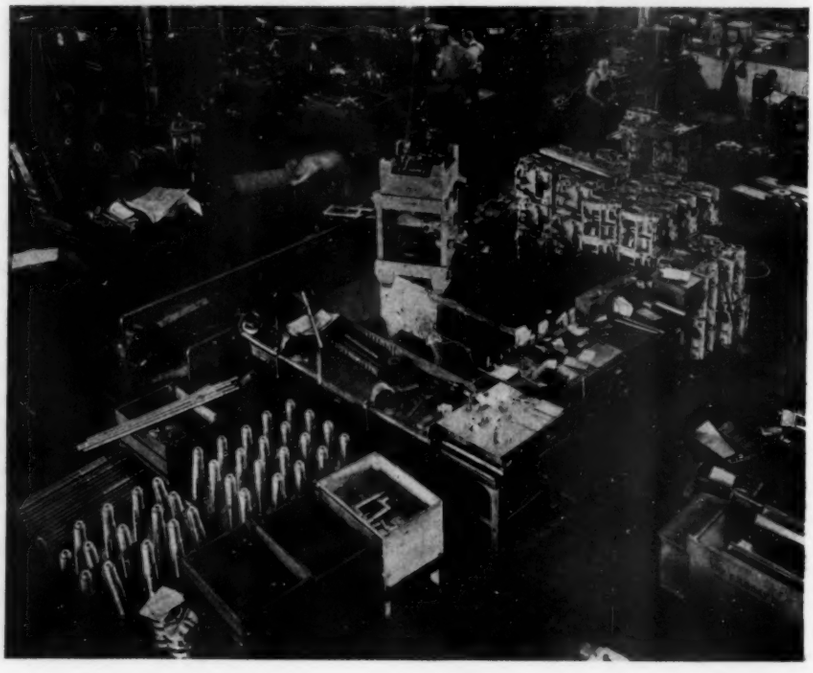
As the output of a cutter, and the machine in which it is used, depends on the "chip per tooth," such machines are being handicapped 75 per cent in their cutting performance. This does not affect the setting-up time nor the work handling time. But in addition to the loss of output it may affect the life of the machine, the fixture, the cutter and the quality of the work.

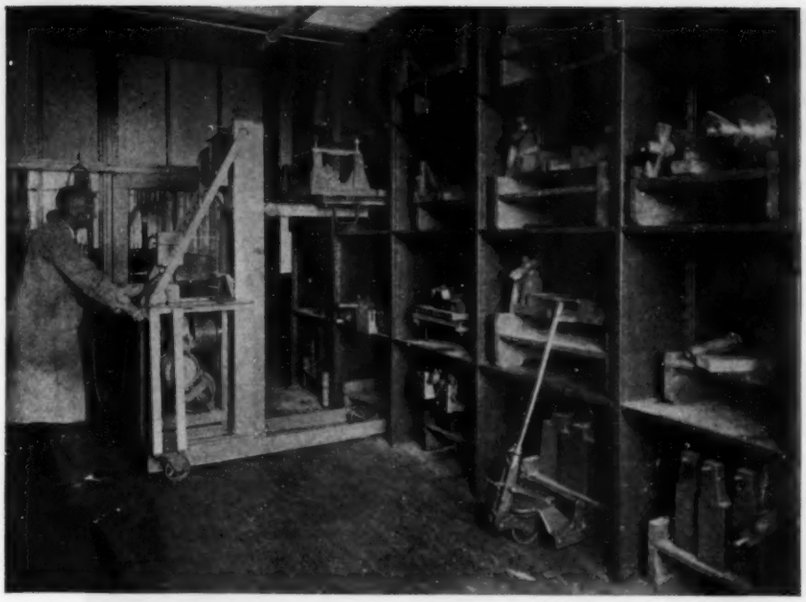
With the cutter grinding machines now available, and the gages which show when the clearance angles are right, there is little excuse for not getting maximum output from our expensive machines.

Fixture Storage

Fixtures, in most cases, are too heavy and bulky to be stored in the tool cribs. They present quite a problem in most shops, the method of handling varying with their size and the moving facilities and storing space available. In the Bullard plant large fixtures are stored beneath the shop floor where space is available in what might pass for a storage

A heavy Bullard fixture on its way to the basement storage





Norton fixtures are handled by lift truck

vault. The fixtures are handled by crane from the machine to the storage opening in the floor, lowered and moved to their proper place. This keeps the shop floor clear and provides safe storage for the fixtures.

The Pratt & Whitney situation is somewhat different, most of the fixtures being smaller in size. Where size permits the fixture is kept in a box together with the tools and gages needed for the job. In other cases the fixture sets on the box as can be seen in the illustrations. Moving the box from storage to the machine department where it is to be used puts the fixture and all tools and gages needed for the job right at the machine.

Both the fixture and the box are plainly marked with the machine number and the number of the part on which the tools are used. The tools and gages are also marked, either with letters stamped into them or by the etching process. For example, the box and tools may be marked "Machine No. 169-A 17-A 18"—meaning that the fixture performs two operations. Unless the machine and part numbers are given, the marking is not complete and has no meaning. These boxes, containing the fixture, tools and gages, are left on platforms so that they can be easily picked up by lift trucks and moved to the machine department where they are to be used.

In some cases stands are provided at the machines to hold the tools so as to be convenient to the workmen while handling the job.

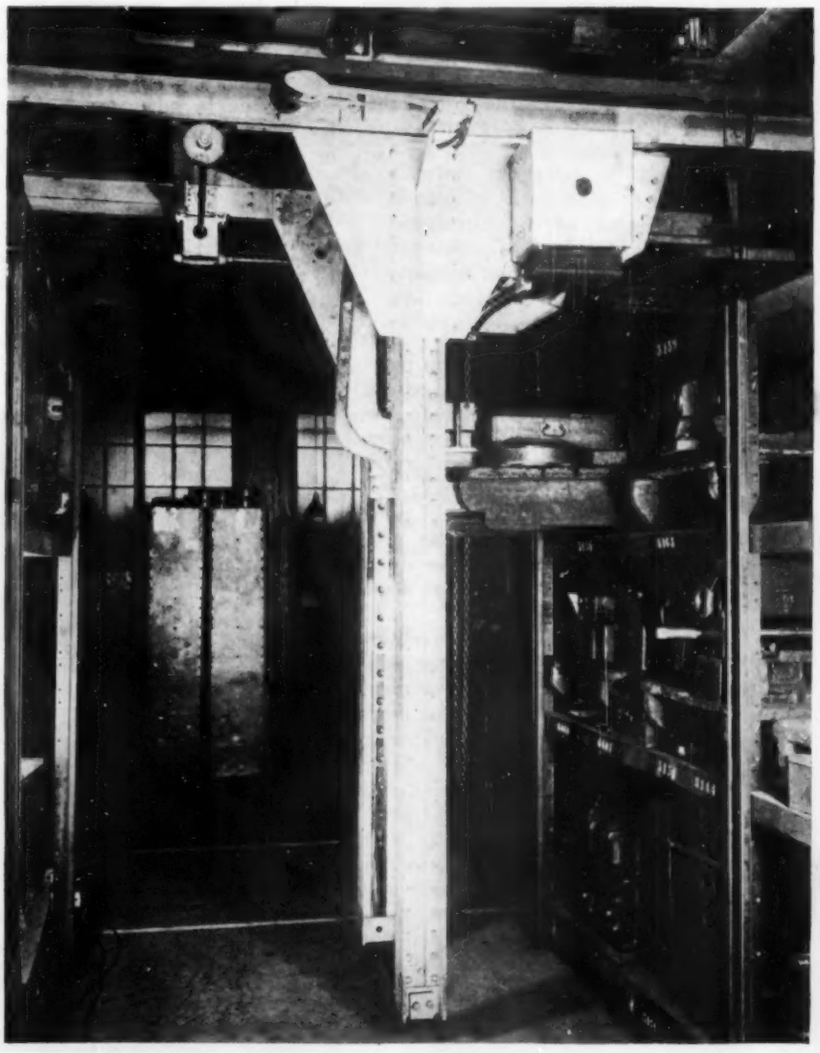
At the American Tool Works plant jigs and fixtures are handled by one man who operates the special crane illustrated. Overhead tracks carry the crane along the front of the storage racks, and into the various bays. Tools and fixtures from all over the shop are delivered to the crane by means of the conventional electric truck.

The same job is done at the Norton Company plant by means of a lift truck. The truck is somewhat more of a mobile unit, of course.

Care of Cutting Tools

When we consider how much the condition of the cutting tools affects the output of machines, the lack of care in storing drills, taps, cutters and reamers is often unbelievable. Cutting edges of these tools are frequently damaged by contact with metal shelves or boxes, or from being piled carelessly on top of each other. The value of the tools themselves is frequently great, but of even greater importance is the loss of efficiency in the machines which use them.

With this crane one man handles American Tool Works fixtures



In the case of reamers and taps the quality of the work suffers. With milling cutters both the quality and quantity are greatly handicapped. No cutting edges should be permitted to touch anything which can damage them. Taps, reamers, milling cutters, broaches and the like should rest against wood or other non-metallic substance, unless it is more convenient to suspend them or keep them apart in other ways. Everyone who handles cutting tools, either at the machine or during grinding, transporting or in the crib, should be taught the necessity for preserving the cutting edges from damage. In the Warner & Swasey tool crib both paper and canvas shields are used to protect the cutting edges of reamers. Canvas shields are cheaper and generally more satisfactory.

Care of cutting tools involves the use of suitable methods of handling them between the tool crib and the machine. If they must be carried in the hand, or under the arms, it is very difficult to prevent damage to cutting edges. The cost of such damage will frequently pay for boxes or racks in which they can be placed while in transport. And unless duplicate tools are available, the loss in time of man and machine is even more important than the cost of the cutter itself.

Getting Tools to the Job

One of the problems of shop management is the method of getting the tools from the tool crib to the machine and back again. The older method of having each man go to the crib and get his own tools frequently involved quite a loss of time, during which his machine was generally idle. Many methods have been devised for eliminating, or at least minimizing, the loss of time.

Some shops have used apprentice boys to get the tools from the crib. Others use messengers, boys or men, who have regular schedules for picking up tool orders and delivering tools to the machines. Flashing lights sometimes call tool messengers and save loss of time waiting for a regular scheduled trip. One tool plant put in a pneumatic tube system for taking tool orders to the tool crib, and for dispatching such small tools as would go in the tube carriers. But even in many large plants the men still go to the tool crib for their tools.

Boys with hand trucks move tools and fixtures at Buick

The tool transport system to be used depends somewhat on the method of planning and assigning work. Where the work orders go to the machines or to the department some time in advance of the date for starting the work, the foreman or his assistant can have the tools and fixtures ready when needed. Sometimes the foreman or his assistant actually get the tools from the crib, or see that they are moved to the machine. In others the foreman sends the operator to the tool crib for his tools. Getting tools back to the tool crib is usually the task of the men who got them out. With heavy tools or fixtures the power driven lift truck is of great assistance, both in labor and time. And where tools are kept in sets, or where the tools for several jobs can be transported at the same time, these trucks help in saving time and labor. At the Norton plant a force of 18 "utility men" on two shifts, including three tool sharpeners, are responsible for getting sharp tools to and from the job.

Pratt & Whitney boring fixture with its two boxes of tools

The American Society of Tool Engineers

FORD LAMB
Consolidated Machine Tool Corporation
President A.S.T.E.

It is impossible to conceive of interchangeability, that is, the making of thousands of identical details, without the assumption of near perfection in form and durability of tools. Nor is it possible to visualize the parts of a complicated assembly passing through a factory from machine to machine and from process to process, in their various stages of manufacture from the ingot to the final assembly line, without also assuming the pre-existence of very careful planning.

In the fewest words, tool engineering is the devising of manufacturing processes, the orderly arranging of their sequence and the designing of all production equipment. To vision the breadth and scope of tool engineering, one need but recall that each machine, and each device used in conjunction with a machine, or any device used by the hand of a workman in any manufacturing process, is a tool.

The development and spontaneous growth of mass manufacturing has had a profound effect upon nearly every phase of human existence today. The continued advancement of civilization will depend largely upon the advancements made in mass manufacturing. But continued development of mass manufacturing can only follow the development of tools.

Because of the growth of mass manufacturing and the consequent importance and immensity of the problems of tooling, they were inevitably divorced from general engineering and the new profession of tool engineering was born.

Master mechanics, tool, die and machine designers, plant superintendents, and other engineers and executives with varied titles had been doing tool engineering nearly as long as it was possible without the benefits of an association which could coordinate their activities, assemble the information they needed, and aid in the solution of their peculiar problems as the older societies have met the needs of their members.

Historians can usually throw a halo of romance around the events or natural actions of an individual or individuals instrumental in pioneering a movement or founding an empire. But it seems to those who founded the American Society of Tool Engineers that heroics had no part in its humble beginning. The time was at hand and the conditions were ideal, so no heroic efforts or sacrifices were necessary.

Indeed, the simple circumstance, or prosaic situation, that really started the American Society of Tool Engineers was the "hungering and thirsting after knowledge" of a group of students of the little Detroit College of Applied Science. They had been conducting a Tool Engineering Society for several years. Aside from considerations of good fellowship, its principal purpose was having experienced tool engineers bring practical information for presentation at their meetings. A meeting was held in February, 1932, and at this meeting the American Society of Tool Engineers was organized.

As master mechanics, tool supervisors, operations planners, time study men, tool, die and machine designers, and other manufacturing executives who appreciated the importance of tooling, learned that those of kindred occupations had organized a society in Detroit, they became members-at-large. As this membership grew in certain localities requests were sent in to Detroit for charters to operate chapters. There are now four chapters in operation and negotiations are under way for the chartering of nine additional chapters.

One of the principal functions of the Society is the asembling of information pertaining to tool engineering and passing it on to its members for permanent record.

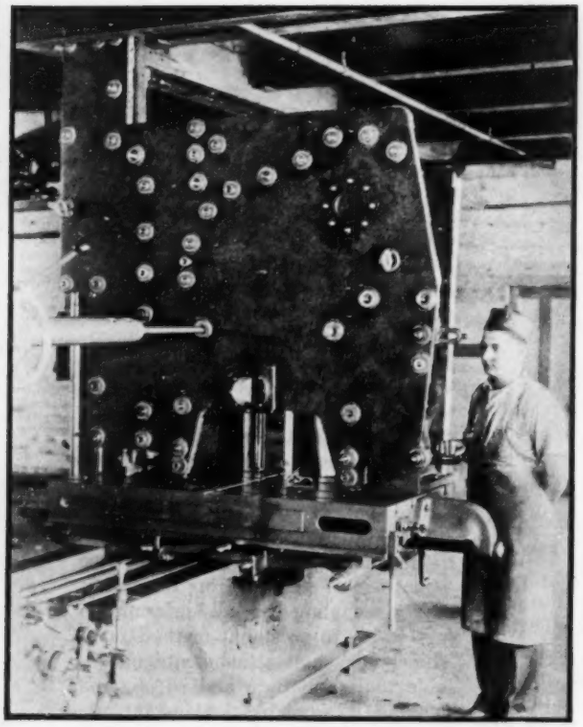
The function of the Standardization Committee at the present time is not one of standardizing but rather the assembling of all information pertaining to processes, methods, machinery, machine attachments, perishable tools and dies, and so on, and making it available for instant use of each individual member. This committee has recently perfected a method of collecting, presenting and preserving this information and has distributed fifteen issues to the membership to date. It is intended that one or more issues will be mailed to members each month until the entire field is covered.

The control of the Society is vested in a national non-salaried board of directors consisting of 33 members elected by direct vote of the general membership. The national officers are elected annually by the board of directors and also render their services gratis. The only salaried employee is an assistant national secretary. It is partly due to this condition of voluntary service that membership dues are so low that practically anyone who is engaged in tooling the mass manufacturing plants which provide for the necessities and luxuries essential to modern living can become a member of this Society.

Where the tool engineer's ideas take shape

Courtesy Taylor Instrument Co.

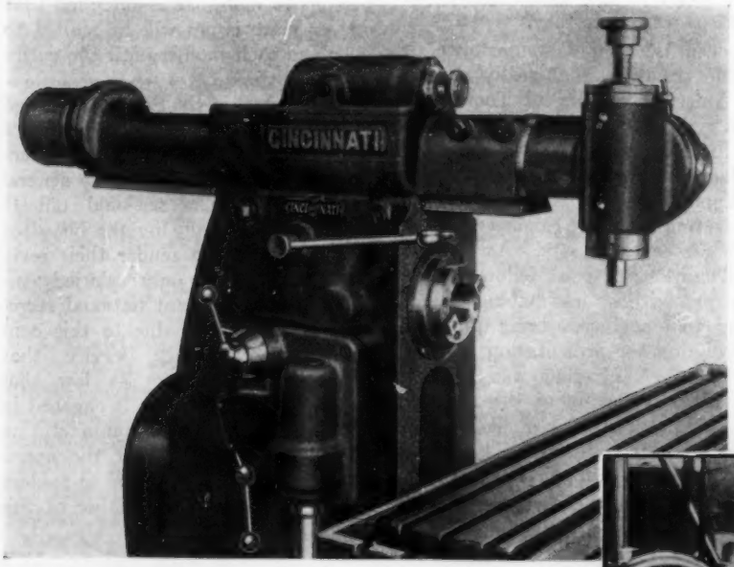
Jig Boring



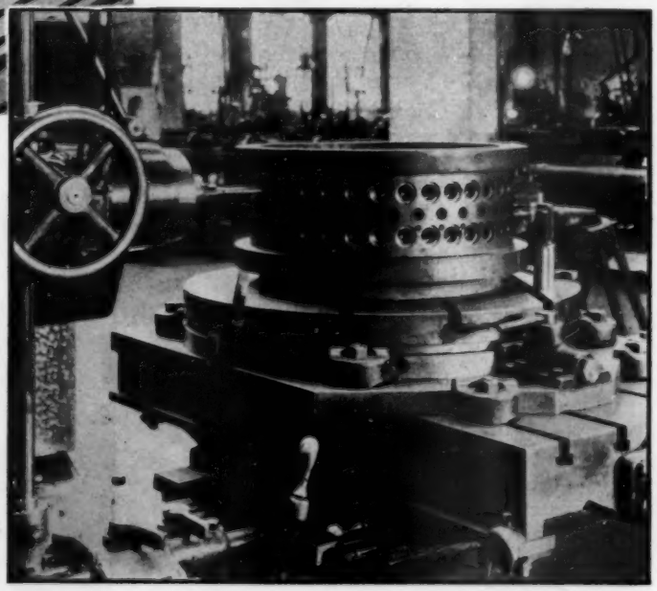
A jig on a Lucas especially suited to horizontal machining on account of size and weight

Locating and boring holes in jig and fixture work can be done in several ways. The toolmaker used to lay the holes out on the bench. Holes were drilled and tapped in approximately correct locations. Buttons were positioned by micrometer measurement, or with the sine bar as one of the tools. Then if the work was not too large it was clamped to the faceplate of a lathe and the first button trued by means of a sensitive indicator. When dead true the button was removed and the hole bored. This was repeated for each button. It was a slow process but some remarkably accurate work has been done by this method.

To save the time of locating a number of buttons the cross feed screws of milling machine table and knee have also been used to locate holes under vertical spindles, and the table and elevating screws in the case of horizontal machines. Here the accuracy depends on the precision of the lead of the screws, and of the graduations of the micrometer dials. Horizontal boring machines have also been used for jig and fixture work for some time. One advantage of the horizontal machine is the ability to handle heavy work with the over-



Cincinnati Milling Machine auxiliary overarm housing with independent motor and universal spindle



Another Lucas horizontal machine job with a rotary table for indexing

Equipment

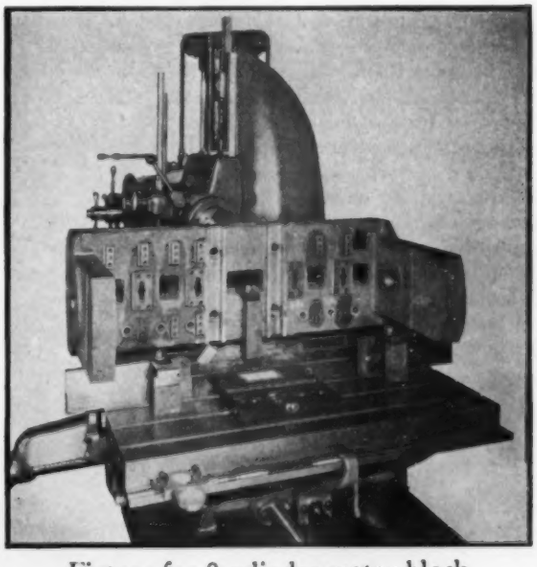
head crane and place it directly on the machine table. Large plate work can also be mounted on an angle plate and is accessible from the side next to the head. Examples of work of this kind are shown.

The vertical type of machine, known as the jig borer, has become very popular for boring holes in fixture work, and for much work where holes are to be accurately spaced and bored. These machines are especially convenient on work within their range, and are even used at times where the size seems beyond their capacity. Jig borers are made for work of different degrees of precision, which is governed by the accuracy of the machine spindle and slide bearings, and of the mechanism by which the work table is moved from one position to another.

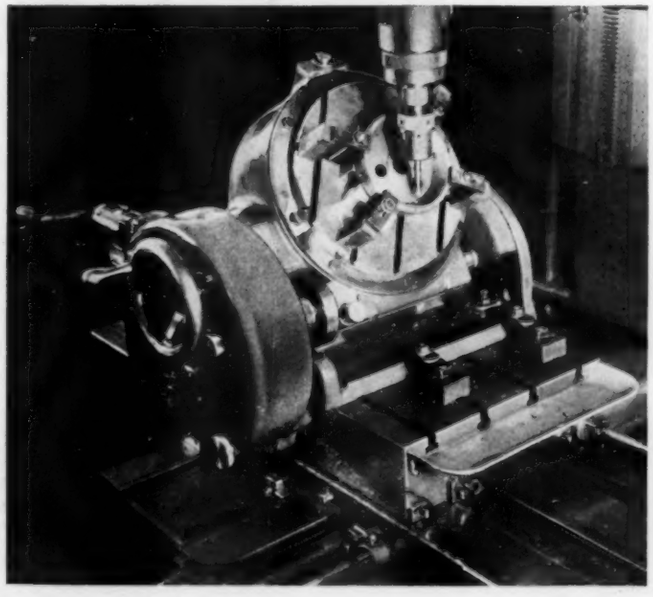
Location measurement by the use of standard gage blocks, or distance pieces, in connection with sensitive dial indicators is used on machines of various types. Both jig boring machines and horizontal boring machines are arranged to use this method of measurement.

With this method the accuracy of the feed screws becomes unimportant, as they only move the table but do not determine its position. The required length or distance is built up by solid gages and no micrometer

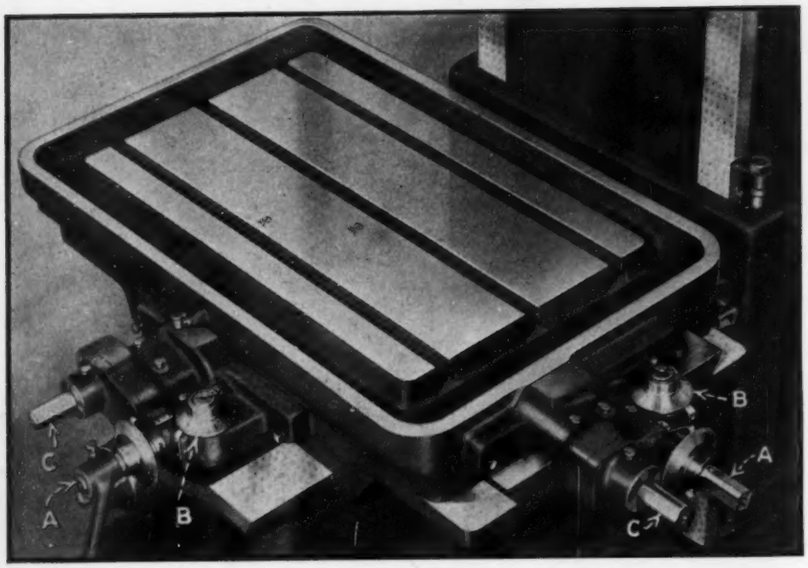
Handling a large bushing plate on a Pratt & Whitney vertical machine



Fixture for 8-cylinder motor block showing gage blocks and indicator used on a Lucas



Using a Pratt & Whitney universal table in boring four 3/16-in. holes at 30 deg. from vertical and accurately spaced



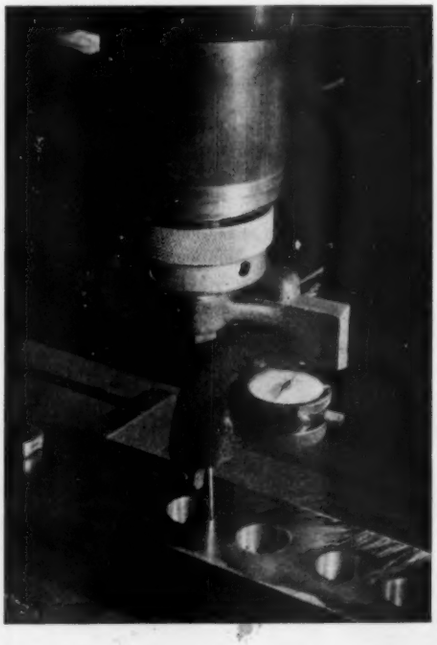
Cincinnati-Bickford compound table for locating work under vertical drill press

reading is necessary. The sensitive dial indicator at the end of the solid gages gives any additional measurement beyond or in connection with the gages. One well known make of jig boring machine uses a screw which is compensated for errors in connection with micrometer dials.

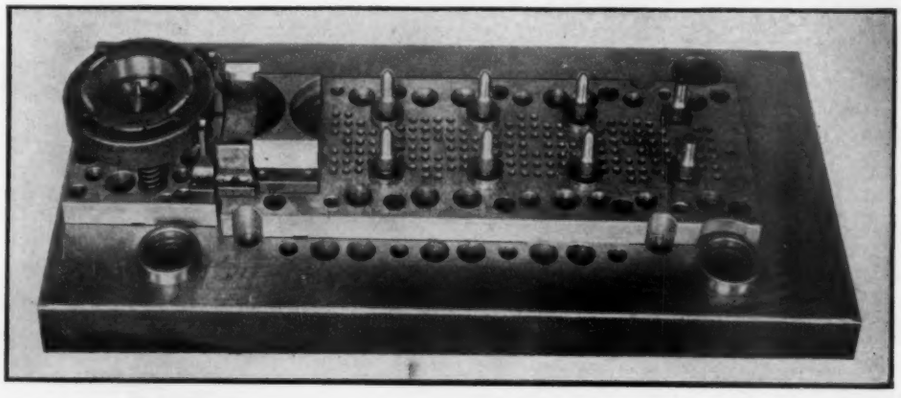
Where extreme accuracy is not required, in other words where a tolerance of plus or minus 0.001 in. is permissible, much jig work can be done rapidly in a good vertical drilling machine on a compound table such as shown. Preliminary adjustments are quickly made by the rapid traverse shaft extensions *C*, in both directions. One turn of these gives a movement of ½ in. One turn of screws *A* gives a movement of 0.100 in. The dials on *A* are graduated in thousandths. Dials *B* are geared to the screws and are graduated in tenths. They are synchronized with the dials on *A*, on which the final readings are taken. This table makes it possible to do a large percentage of jig boring work on a simple machine, thus saving the jig borer for the precision work to which it is so well adapted.

Where the milling machine is to be used for jig boring there is now available a special housing which replaces the overarm. This housing carries its own motor at the back and a universal spindle in front, which permits work to be drilled or bored at any angle and also leaves the regular horizontal spindle ready for use if needed. It is especially useful on light work.

The illustrations do not show complete machines since these are well known. They show for the most part jig boring operations on various machines, and require no explanation. They are but a few of the many applications of boring machines and jig borers to the making of fixtures and similar work. Appreciation of the usefulness of machines of this type grows with experience in handling a great variety of work. These machines have also had an influence on the making of drawings for such work. For, as the hole locations are found by measuring from two positions, vertical and horizontal, drawings are now marked in this way instead of using angles and center distance as when sine bars were almost universally used in laying out the work.



Checking location of a series of holes in a Pratt & Whitney jig borer



Here is a sample of nice locating and boring in a complicated die set. The holes are all located by gage block measurement on a jig borer

The Special Tool, Die and Machine Shop Institute

FREDERICK S. BLACKALL, JR.
President and Treasurer
The Taft-Peirce Mfg. Co., Woonsocket, R. I.

It is curious that the Special Tool Die and Machine Shop Industry, comprising the contract manufacturers of special tools, dies, molds, jigs, fixtures and special machines and embracing something between 4,000 and 8,000 separate units blanketing the entire country, should have failed to organize itself into any national trade association until a little over three years ago. The reason probably is that TDM members are to a large extent individualists. In countless cases shop owners and executives have risen from the ranks and a great majority of these contract shops are built around the owner, a "master mechanic" who has been forced not only to devote his energies to building up a soundly established, capably manned and efficient organization whose success depends on being able to compete with his customers' own costs, but who is expected by his customers to have a real working knowledge of the industries which he serves. Tools, dies and special machinery are the fabricating units in mass production and it is axiomatic that the operator who would make his business the design and manufacture of these units must thoroughly understand their application.

Adjusting to NIRA

The advent of the National Industrial Recovery Act in June 1933 suddenly forced upon this industry a new set of conditions and problems for which it was wholly unprepared; and the need for effective national organization became at once apparent to leaders of the industry in most of the larger centers of the country. Local organizations were formed at once, or hastily strengthened if already in existence, at such focal points as Detroit, Chicago, Dayton, Cleveland, Philadelphia, New York, and New England; and by the early days of August 1933, these scattered efforts began to weld themselves through intercity contact into a concerted attempt at national organization. In the latter days of that summer, the first national convention was held at Cleveland.

In this convention the Special Tool, Die & Machine Shop Institute had its birth, and its founders may view with no little pride the accomplishments of this vigorous young organization over the ensuing three years.

With efficiency and despatch, a code was drafted and in November 1933 approved by the NIRA, in advance of many codes promulgated by older and more experienced organizations. The code provisions secured from the Administration can only be regarded as generous from the point of view of the interests of the industry.

The plethora of toolmakers' strikes which broke out during the ensuing winter were dealt with in an understanding and efficient manner by the Institute; and the localizing of trouble and minimizing of further disputes was in no inconsiderable measure due to effective work of Institute officers and active members.

Under the Presidency of J. J. Kohl of Dayton, and the secretaryship of Roy T. Wise, the Institute's first Managing Secretary, the industry's official magazine "Progress", was founded, an activity which has continued to be one of the major works of the association, with a genuine record of accomplishment in selling tool, die and machine shop service to industry. Not least important among the Institute's activities during the code era was the vigorous work which it attempted to perform in code enforcement. Unfortunately, its efforts in this direction were too often nullified by political red tape and administrative delays in Washington, but the Institute's record in this respect compares most favorably with that of other trade associations.

In January 1935, Roy T. Wise was succeeded as Managing Secretary by George J. Huebner, then secretary of the Automotive Tool and Die Manufacturers' Association of Detroit, the Institute's local unit in Michigan. Huebner brought to the Institute unusual talents and experience for this work. In Detroit he had handled the affairs of the Michigan unit during a labor strike. Subsequently, he had instituted an employee registration system, which today comprises complete records of more than 10,000 skilled tool and die makers in the Detroit industrial area, including such valuable information as the detailed experience of each worker. This registration was completely voluntary. Skilled workers, when they realized the purpose of the registration, freely and frankly supplied information as to themselves, and the system now operates as a clearing house for skilled labor which has been adapted to other groups and industries.

The demise of NRA in the spring of 1935 naturally removed from the Special Tool, Die & Machine Shop Institute the policing and code administrative activities which it had assumed with reluctance in the first instance. Compulsion gave way to cooperation as the Institute entered a new area, and in the autumn of 1935 another national convention was called at Cleveland to determine its future course.

Continuing Cooperation

After two days of full discussion, it was concluded unanimously that the need of a trade association for the industry was deeper and more basic than that of a mere code enforcing agency and that it should by all means continue as a clearing house of information, and as a rallying point for defense against encroachment upon the industry's rights and prerogatives, governmental or otherwise. Not least of the functions which it was felt the association could effectively perform, was that of institutional publicity. The important place which tool, die and machine shops play in rendering possible the mass production in which America leads the world is too often overlooked by industry at large; and the Institute, through its official publication and through contact with trade journal and general publications, has done good work in advertising the industry's services and wares.

Officers of the Institute are as follows: F. S. Blackall, Jr., President; N. A. Woodworth, Vice-President; George J. Huebner, Secretary-Treasurer, Box 3561, Cleveland, Ohio.

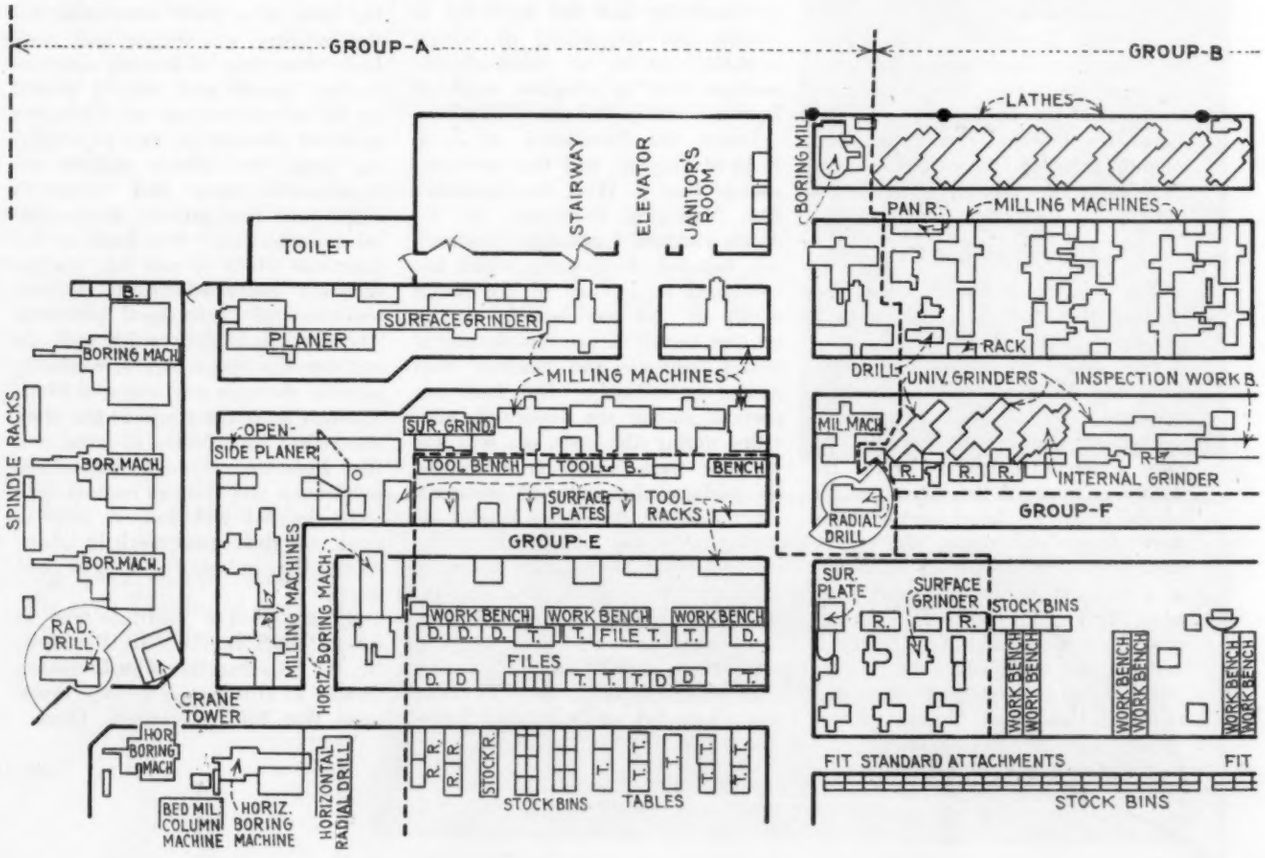
Classified Tool Work

Cincinnati Milling Machine Company has divided its tool room into six departments some of which are completely self-sufficient

Within the last few weeks the Cincinnati Milling Machine Company has completed the rearrangement of the special manufacturing department layout. This improved set-up became necessary because of the increased use of tools and jigs in their shop and the desire to provide quicker delivery of fixtures, special units and special machines for customers. These requirements had also materially increased the number of machine hours charged against the department. The department itself had grown so large that most of the supervisor's time was spent in locating jobs, delegating them to trained men capable of performing a particular kind of work, and then keeping the hundreds of jobs moving in such a way as to satisfy the demands of the shop as well as of customers.

In the average plant, men are trained for certain classes of work and have learned through experience the limitations and requirements of these jobs. In the past the general foreman have tried to delegate this work to the men, but it became extremely difficult to handle such a large department and at the same time look after all of the details connected with each job. In order to overcome the above mentioned difficulties, the special manufacturing department, known as Dept. 1100, was divided into Groups "A", "B", "C", "D", "E" and "F", as indicated in the floor plan layout.

Each group is now responsible for certain classes of work and has been supplied with trained men and machines suitable for the jobs which it is called upon to do. The foreman of the group looks the complete job over where formerly three or four supervisors were required to do this same thing. In addition, the men under the supervision of the group foreman become familiar with the type of work assigned to that group and can thus go ahead with considerably less supervision. The



variety of work assigned to any particular group is only about one-fourth of what it has been in the past.

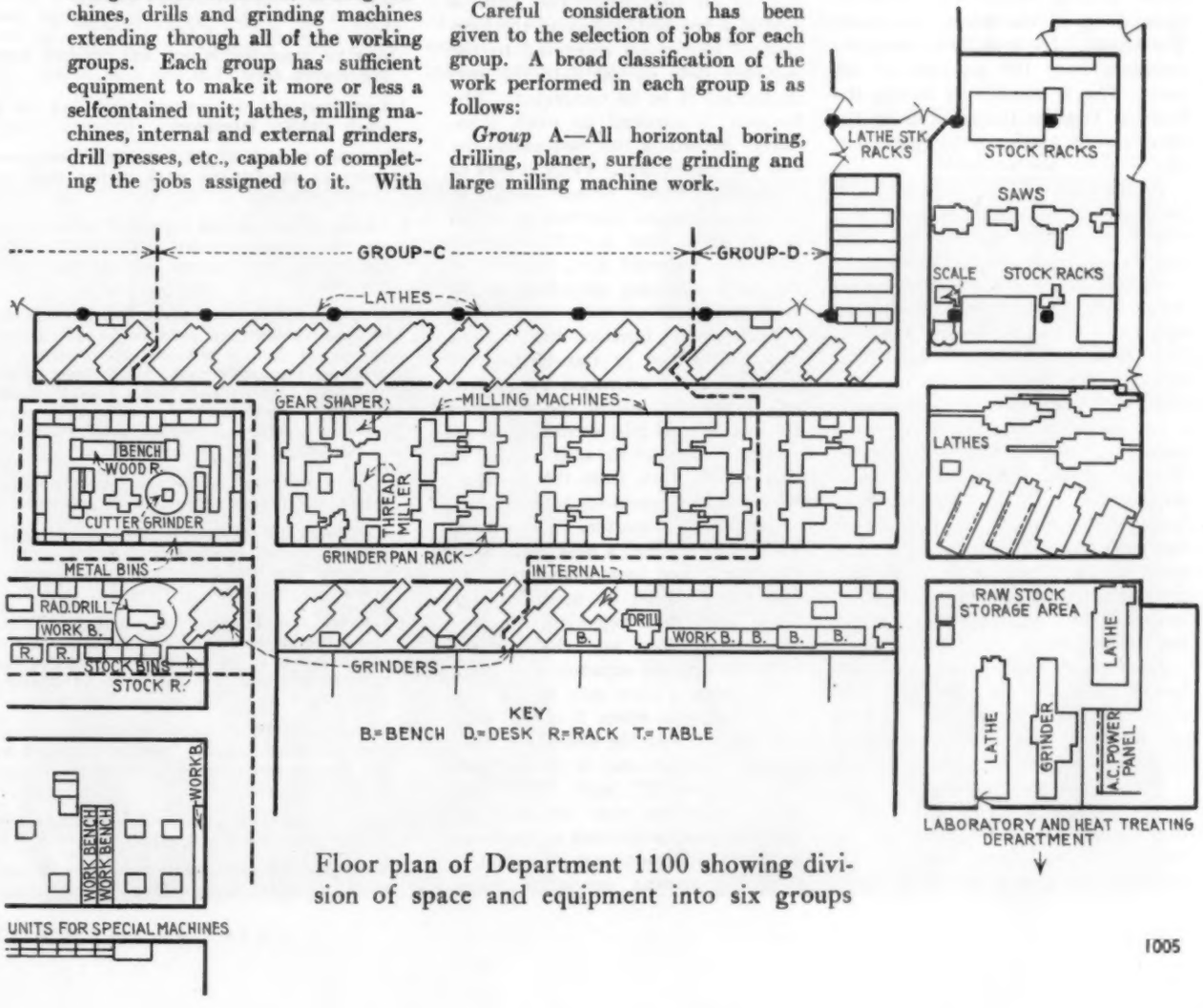
Probably one of the biggest advantages is that the foreman knows where any job is at any particular time because of the limited area of the group. Jobs are now finished in fewer days and more of the foreman's time is spent on mechanical rather than clerical duties. By dividing up a large job of many pieces among the various groups, they are now able to complete a job in fewer days and thus meet the promised delivery dates.

A brief description of the floor layout will serve to show the extent to which this department has been broken up into the various groups. In this division there are 35 milling machines, 9 precision grinding machines, 5 cutter and tool grinders, 33 lathes, 2 planers, 3 internal grinders, 7 boring machines, 5 surface grinders, 5 upright drills, radial drills, thread miller and gear cutter, etc. These machines are divided up into straight lines of lathes, milling machines, drills and grinding machines extending through all of the working groups. Each group has sufficient equipment to make it more or less a selfcontained unit; lathes, milling machines, internal and external grinders, drill presses, etc., capable of completing the jobs assigned to it. With this set-up, if the foreman can handle more men or if he has too many men, both machines and men can be assigned to him or taken away, as the case may be, without materially changing the location of any equipment or machines.

One corner of Group C showing overhead crane

Careful consideration has been given to the selection of jobs for each group. A broad classification of the work performed in each group is as follows:

Group A—All horizontal boring, drilling, planer, surface grinding and large milling machine work.



Floor plan of Department 1100 showing division of space and equipment into six groups

Group B—General class of very accurate machine shop work.

Group C—General class of machine shop work.

Group D—Hand screw machine work, chucking lathe work, and a general line of work run in quantities.

Group E—Vise work on all shop tools.

Group F—Fitting and assembly of special machines and special attachments.

Horizontal boring, as stated above, is performed in Group "A". The vertical boring mill has been added to this group because there is a great deal of work which is ordinarily handled on the horizontal boring machine that now can be done on the vertical machine. Work is likewise transferred from the planers to the boring machines and to the large milling machines, depending on the load assigned to a particular machine. Surface grinders are also placed in this department because their work is closely related to the planer work. Large radial drilling machines perform operations similar to those done on the boring machines. The object, of course, is to keep the machines busy 100 per cent of the time. This is possible by having the foreman transfer the work from the overcrowded machines to other machines which are available.

Practically all of the cast iron parts are machined in Group "A", which is at the end of the large bay extending from the foundry.

Group "D" has a separate cut-off department and a separate stock storage. The object in storing and cutting off its own steel is to keep from dividing the responsibility of handling tool steels and the alloy steels.

Forgings come into the group in the same way as the rough bar stock. The heat treating department is also adjacent to the place where the forgings are machined. The lathes near the heat treating department handle most of the large spindles. In this group the work is completely finished, including heat treating, turning, grinding and inspecting.

Each group has an adequate number of inspectors equipped with precision gages and devices for checking all finished jobs against precision limits specified on the part drawings.

There is a separate tool store which serves all groups. The tools in this department are only given out to those carrying check numbers assigned to the groups described. Delicate measuring tools, which are only used on certain types of work, are never given out to men who do not understand their correct use. Emergency sharpening and reconditioning of tools is done here. Reamers are set for special size holes, and special cutters are sharpened when required for a definite job, but ordinary tools go to the main tool stores for sharpening.

Method of Tracing

The method employed for tracing a given job is important. The order issued by the production department is sent to the general foreman of the entire department who immediately selects the group to whom the job shall be sent for machining. If it is a very difficult piece with extremely close limits specified it is assigned in Group "B", and accordingly the foreman marks "B", on a card allotted to this particular piece. This card carries the shop order number, part number and name, and the sequence number showing when the piece is to be completed. This card is then taken to the time setter where the time allowed for completing the job is stamped on the part drawing as well as on the card. This card is filed in a box at the desk of the foreman of the group according to the sequence date or the date the particular job is to be completed. The foreman is required to work absolutely according to sequence—the first job comes first. Petty orders or customers' repair orders carry an "A" sequence and therefore go ahead of any date, that is, "A" sequence jobs are completed first, the rest of the work following according to the date specified.

Each group foreman has a clerk who assists him in transferring the work from one operation to another and seeing that all of the machines are working on jobs according to sequence. This clerk also assists in moving the work from the machine, after the last operation is completed, to the group inspector. The card is left at the foreman's desk until after the work has been inspected. In case there should be need of additional work or a rejection, the card is correctly filed and the job run under its original sequence.

The part is then sent to the centralized storage where it is held until it is given out to the assembler. The assembly department is divided into two groups—"E" and "F". One group assembles tools for shop use; another group is devoted to Engineering, Service Department jobs; that is, special equipment, special machines, and special attachments. Everything that is not of a standard nature is done in he special machine department. If machines are not entirely standard, this department gets the order, manufactures, assembles and runs the machine off. If standard machines which are built in the standard assembly lines require any special tools, or if the machine is to be tooled up for any special job, it will be moved from the regular assembly line into this department to be run off using the customer's sample. This work is thus kept out of the regular production lines preventing interference with the building of standard products. The men in these assembly departments are trained to handle this type of work. The men in the regular manufacturing departments are expert in their class of work, but they would have difficulty handling special jobs.

In conclusion, it is well to summarize the many advantages claimed for the new arrangement:

1. **Short material flow providing prompt service on special fixtures and special machines for customers.**
2. **Fewer days required to complete a given job. A part which formerly required five days in process and 655 ft. of moving can now be processed in one and one-half days and moved only 77 ft.**
3. **Less material in process, resulting in a much smaller inventory.**
4. **Greater percentage of foreman's time now spent on mechanical work rather than on clerical details.**
5. **Closer inspection and control of job in process. Better workmanship. Reduction in spoilage because men become more familiar with the job.**
6. **Much easier to trace parts. Quick check-up of load against any machine in any group, easily and quickly obtained by reference to cards at foreman's desk, with closer tieup between tracer and foreman. Provides shorter deliveries on booked orders and gives more satisfactory deliveries, a valuable aid in obtaining future business.**
7. **A complete and improved control of man power and proper placement of supervision.**
8. **Flexibility in set-ups. Better scheduling of work. Jobs can be transferred from one machine to another depending upon the load given the machines.**
9. **Correct raw material for each job direct from source of supply to machines upon which job is to be handled. A straight line movement from raw materials to finished parts, then to various assembling areas.**
10. **Close proximity of machines and centralized tool stores. The men's burden lightened by the use of many cranes and material handling equipment.**
11. **Better light with safe, orderly arrangement of the latest machining equipment.**
12. **Machines and equipment within the department, accessible for cleaning and operating.**

Microscopes In the Shop

A few of the many possible applications of the toolmaker's microscope were described in the article on pages 985–987. To round out the picture some of the others are listed in what follows.

1.—For accurate dimensioning of diamond tools and wire drawing dies.

2.—For platinum processing in the manufacture of spinnerets for rayon.

3.—For checking and inspecting tools used in making safety razor blades.

4.—For precision layout of watch and watch part tools, and for measuring and checking shaft and bearing diameters and jewel sizes.

5.—For inspection of plating thicknesses.

6.—For checking the tools used in making vacuum tube and incandescent bulb filaments and small parts, and also the parts themselves.

7.—For dimensioning and checking the intricate dies used in the manufacture of slide fasteners.

8.—For measuring film perforations, inspecting sound tracks and checking registration of color images in the motion picture industry.

9.—For inspecting tools used in making dental burrs and broaches.

10.—For measuring powder grain sizes, bullets, bullet moulds, shells and shell dies, bullet and chamber deformations in the ballistics field.

11.—For measuring the effects of temperature change in surveying instruments.

12.—For inspection of all kinds of gages, precision dies and cutting tools such as taps and hobs.

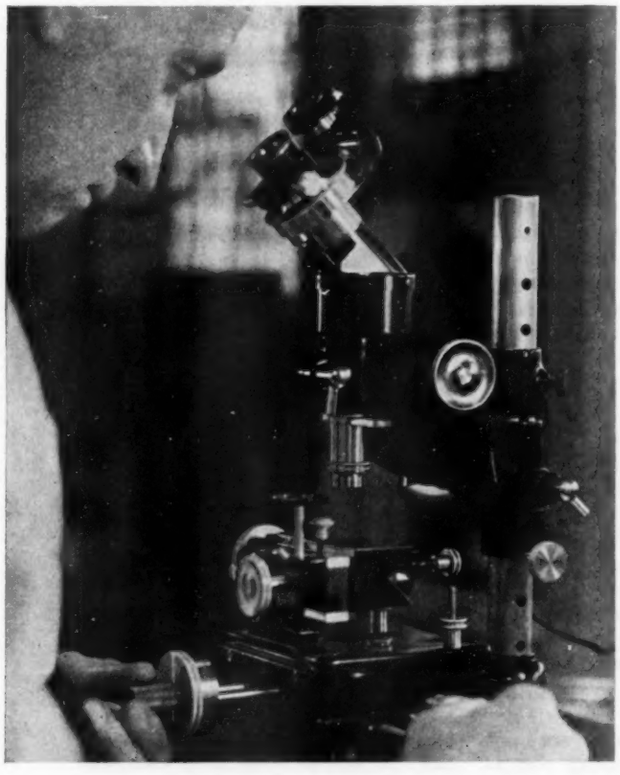
Many of these operations demand the use of supplementary equipment. Much of this equipment has been worked out by the microscope manufacturers, the rest of it must be devised by the user in his own tool room.

Besides the applications of the toolmaker's microscope as an independent unit there are examples of its use mounted directly on a machine tool where it can be employed to check work still in the machine. There is a wide open field for further development in this sort of application.

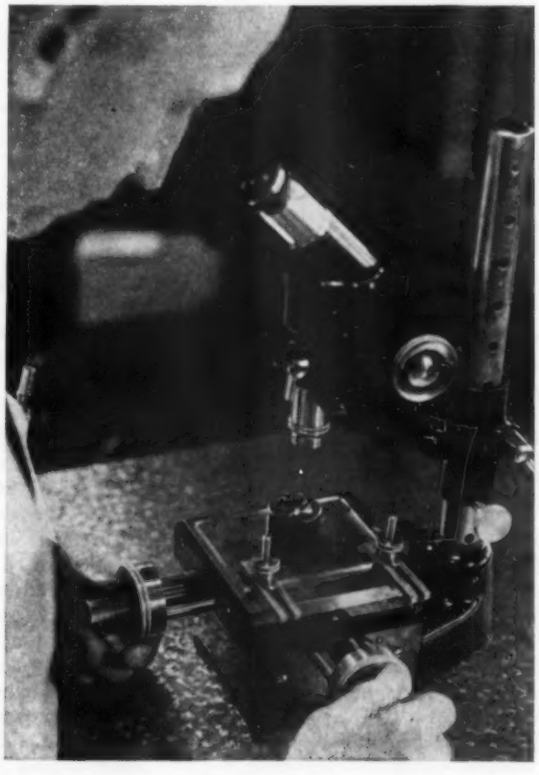
Photographs courtesy Bausch & Lomb Optical Co.

Measuring the characteristics of a microscope rack

Screw thread checking with goniometer eyepiece



Examining the contour of a small die hob

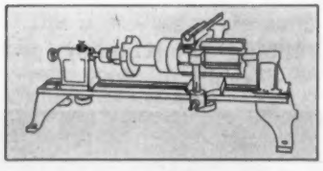


Tool Room Aids

Samples of the equipment devised to make standard tool room machines more versatile and to facilitate the toolmaker's work

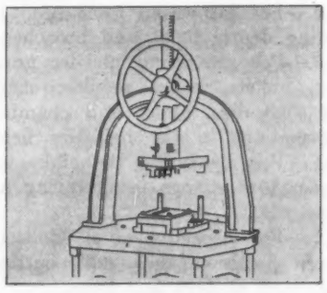
TOOL GRINDERS that sharpen all sorts of cutting tools, from taps to milling cutters, are common in tool rooms. There are also special reamer grinders that have found favor in large production shops, but which can hardly fit into the average tool room.

There is also a small, hand operated bench machine that is comparatively new. It's a reamer sharpener that uses hones instead of grinding wheels and that maintains the proper clearance angle to the reamer blade. Hand honing has been used



for years, only we formerly used oil stones and called it "stoning." But it is too easy to let the hand hone slip and round over the cutting edge. This danger is eliminated with this little machine.

DUPLICATING PROFILES is one of the ticklish jobs that comes into the tool room at times. If it means simply copying the profile from a flat sheet gage, the job is easy. But when they bring in a piece of work, or a model of irregular or unusual shape and want you to make a gage or templet to duplicate it, it's a real job. There is, however, a very clever form of profile gage available that makes it easy for the toolmaker to duplicate practically any form that may be wanted. It is easy to use and can be changed in a jiffy from one form to another. Almost any tool room will find a gage of this kind a great time saver when it comes to such work.

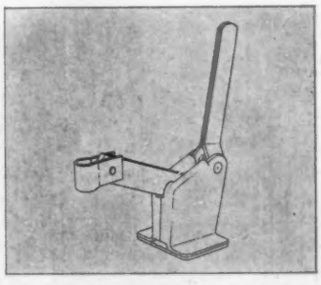


TRYING OUT a die, after it is made and before it goes out to the production line is part of the job, as the toolmaker wants to see how it works. So, instead of tying up a punch press for such trials, modern tool rooms use a small hand machine that is first cousin to an arbor press. It is easy to put the die set in place, easy to handle and operate, and is frequently on casters so it can be easily wheeled to any part of the tool room. This is another time saver that has been developed in recent years.

Then too, there is a tryout press made for whopping big dies, with a bed about 140x160 in. This is more for forming dies and of course is only for the tool room handling large work. But it's a tool room development just the same.

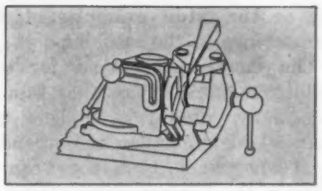
TOOL HOLDERS, lathe or grinding machine dogs, clamps of various kinds and even wrenches are tool room accessories so commonly used that their importance is apt to be overlooked. Few toolmakers now grind a thread tool to the thread angle. Instead they use the tool bits that fit the particular tool holder, and the 60 degree notch in the center gage no longer plays the important part it once did.

Dogs for holding work are now drop forged instead of being cast as was formerly the case. Safety set screws have removed the hazard from the old projecting screw and the use of two screws is sometimes a convenience. Clamps are also drop forged and can be lighter and less bulky. Every toolmaker uses them without perhaps, appreciating their importance. Wrenches too play their part in modern tool room work. The adjustable screw wrench, which has largely outgrown the old "monkey wrench" days, still has its place. But with the standardization of nuts and bolt heads, the solid wrench is a great convenience. Made with the jaw openings at convenient angles and of various thicknesses they are much easier to use and far less liable to slip and mar the nut corner or skin the knuckles of the user.

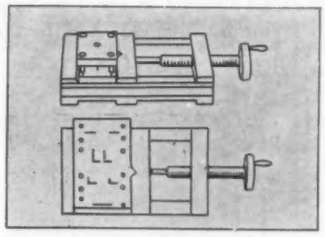


Toggle clamps are also great time savers where they can be used. One maker now supplies them in a variety of sizes and styles and large tool rooms, as well as small, find them very useful.

BENCH VISES are among our oldest shop appliances, yet there are many cases where swivel bases, and better yet a double swivel, would save a lot of time in the tool room. Instead of contorting into awkward positions to get at certain parts of the vise job, some of these vises will

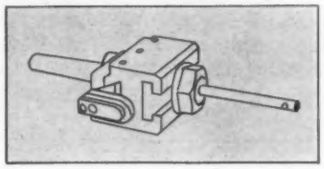


put any part of it just where the toolmaker can get at it easily. Other vises have multiple jaws that grip long work between two pairs of the jaws and hold it solidly, and others hold taper pieces as easily as straight.



When it comes to machine vises, for drill press, shaper or miller there are several things to consider. Too many of them have the tendency of cocking work up when two or more pieces are held at once. Some vise makers have realized this difficulty and have designed vises that equalize the pressure.

SINGLE POINT boring has gone through many stages so far as the tools used are concerned. Boring tools, or tool heads, in which the tool point could be set off, or adjusted, more or less accurately, are no longer



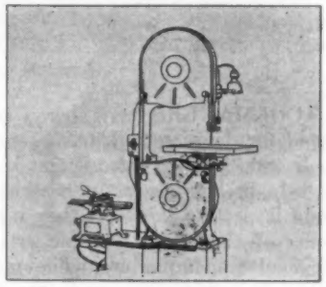
novelties. Designs have been improved, however, both as to rigidity and accuracy of adjustment.

Round heads with radial or eccentric adjustment and heads of rectangular shapes vie with each other in popularity. The range of sizes, the rigidity and ease of accurate adjustment, vary with the design.

SLOTTING OUT A DIE or cutting a keyway on the shaper is not new. Most toolmakers have at one time or another used the shaper in this way. Such jobs usually mean rigging up some sort of a makeshift, both as to the tool and the way to hold it. To save time in shops where a slotter is not available, one concern supplies a tool-carrying head that can be readily used in place of the tool post on a shaper. It is a simple device that permits the use of a rigid tool without a projecting tool post being in the way. A friction arm prevents vibration and brings the clapper back in position before the cutting stroke begins.

BAND SAWS for steel, for cutting out dies or for other purposes, are comparatively new in the tool room —and are great time savers. The use of electric brazing clamps has made the band saw available for internal work. It takes very little time to braze, or unbraze, (this is frequently called "breaking") a saw, and put it through a hole ready for internal work. Speeds are adjustable according to the kind of material to be cut and outlines can be followed very accurately.

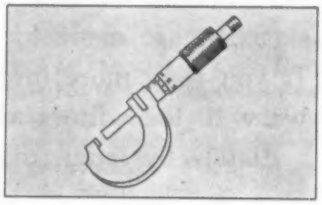
One type of machine uses a long saw that is not brazed. One end is



threaded through the hole and clamped to a drum. The cut that can be made continuously depends on the length of the saw which is usually well over 150 feet. When the saw has been wound on the lower drum it is reversed and runs back at high speed, for another cut. This avoids the necessity for brazing but lacks continuous cutting. There is also a machine which uses a hacksaw blade vertically, much in the jig saw manner, for certain tool room operations. Standard band saws are 0.025 in. thick and from ⅛ to ¼ in. wide.

NON-FERROUS ALLOYS, some of the new ones especially, are creeping into the tool room in places where hardened steel formerly held sway. Guide pin bushings are a case in point. These bushings are now available in standard sizes. Some of them have a very hard surface which gives long life, but, owing to the nature of the metals, there is no seizing or galling as sometimes happens with steel bushings on steel pins.

CEMENTED CARBIDE tools may not find their most economical field in the tool room where production is not a vital factor. But this



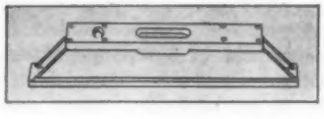
material is finding plenty of uses in gages of various kinds. Tips for micrometer contact points, for gear tooth calipers, for dial indicators and many other tools, greatly reduce the wear that comes with constant use. Carbide tips on centers for lathe and grinder work are also becoming more common, while for dressing abrasive wheels in the tool room we now have a diamond impregnated carbide tool that is making a name for itself.

MAGNETIC CHUCKS and accessories for tool room use have received a lot of attention. Chucks themselves are being made more powerful as well as more convenient. Control devices and demagnetizers make these chucks easier to use than in the past.

Among the accessories are magnetic jig blocks and parallels made to give maximum gripping power to work of various shapes. V-blocks and guide pieces of various shapes also help in using magnetic chucks on a variety of work.

PRECISION LEVELS have been found of great assistance in leveling beds of planers and boring machines. Accuracy in planing, boring and in some other tool room machines, depends largely on the alignment of the machines themselves. A level base or bed is the starting point for an accurate machine.

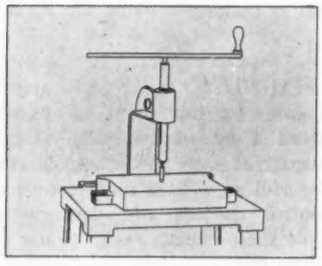
The main vial is ground and



Where to Get Them

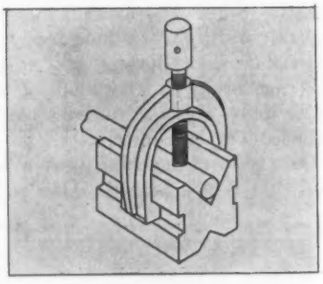
ANY ATTEMPT to include in one article all of the many useful devices that have been invented for the tool room is hopeless because there are so many of them. No tool room machine tools at all have been mentioned here because of lack of space. Most of the devices sketched are made by more than one manufacturer. If you want more information on any of these items write to the editors and it will be furnished immediately by letter, together with a list of makers.

graduated to 10 seconds accuracy. One division on the scale indicates 0.0005 inch per foot. An auxiliary level aids in setting the true horizontal by showing the position laterally. Levels of this kind also have a place in assembling large, intricate fixtures in the toolroom.



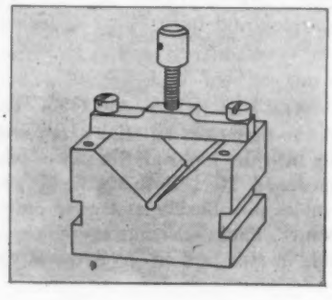
HAND TAPPING is largely confined to the tool room on jig and fixture work. And here, as in most other cases, the holes must be tapped square. Instead of the regular tap wrench and the try-square to check squareness, there are simple little machines that hold the tap square with the work—and save a lot of time besides.

DRILL RODS are used in all tool rooms, but there is no standard method of storing them so that they are readily accessible and yet out of the way. One concern has devised a compact rack that holds 32 sizes of standard lengths vertically, and where all are accessible. Each size is held in a separate container that can be easily removed from the rack to get at short pieces of rod.



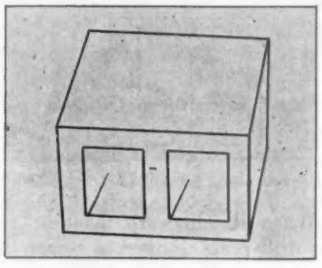
TOOLMAKERS have always been noted for devising and making small tools and "gadgets" of different kinds to help in laying out, in machining, or in inspecting the tools they made. Some of these later became articles of regular manufacture while many still remain hidden away in the tool box, often because they did not have sufficiently wide application to warrant manufacture.

Sine bars and buttons are still used in many shops but in others the use of micrometer, or gage block, positioning of the work to the spindle, as in the jig borer, has become a standard method. This method is practiced on accurate horizontal boring machines and milling machines as well as on the jig borer itself. It is



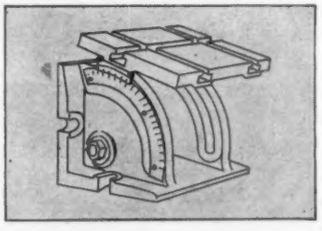
one of the latest examples of skill transference to the machine.

The increasing demand for tools and toolmaker's devices has brought out many interesting designs that can be bought for less money and of greater accuracy than they can be made in the average shop. These include sine bars of various designs and fixtures that aid in holding them while in use. With a fixture that holds the sine bar over a surface plate it is easy to measure the distance of the studs from the plate and so get the angle of the bar. This is particularly useful in checking tapers and laying out angles. Add to these



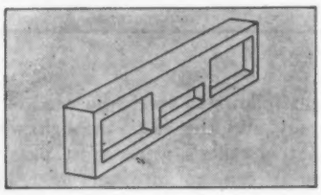
one of the modern vernier height gages and the toolmaker can lay out or measure almost anything that comes along.

An adjustable knee or angle plate, as now made for toolmakers, has many uses, especially in connection with the height gage and sine bar already mentioned. Angle plates of various kinds, both for holding work at right, or other angles, and for

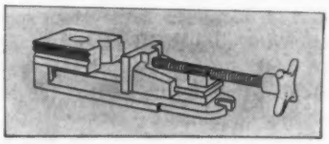


checking work by serving as a base from which measurements can be taken, are most convenient in the tool room. Squares too have changed greatly since the miniature of the carpenters square was the only kind available. The so-called cylindrical squares made from hardened, seasoned and ground steel bars with the ends ground square with sides, have become regular tool room equipment. So too have the "universal" squares made up of rectangular steel plates with two flat and two knife edges. Recognition of the effect of temperature on measurements is seen in the provision of a hard rubber pad which protects the gage from the heat of

the hand as well as providing a good grip for the fingers.



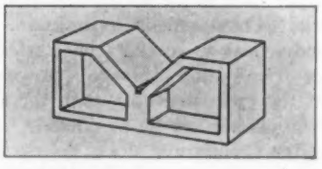
V - blocks, parallels, levelling straight edges, surface plates and similar equipment that every tool room accumulates as the years go by, are important additions that facilitate the rapid and accurate production of good tools. In too many cases shops continue to use makeshifts that are not as accurate as they should be and that waste time



because of their inconvenience. It is important that angles and surfaces be correct if the work is to be right when finished. Straight edges that are not straight, and angles that are just a little off the correct angle, should be corrected or thrown away. It is much better to buy equipment of this kind from those who specialize in its manufacture.

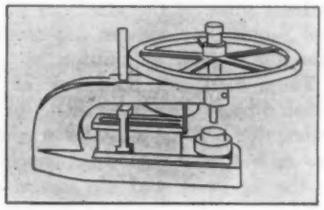
In addition to the devices named there are now many special measuring tools available for the toolmaker. While the vernier has largely given way to the micrometer for calipered measurements, the vernier still holds sway on such tools as height and depth gages. Micrometer measuring methods are also used on these instruments.

Surface gages and test indicators of either the arm or dial type are both essentials in laying out work and in centering holes, bosses, but-



tons or the like. Squares, protractors, bevels and trams are also parts of tool room equipment, not to mention gear tooth calipers and rules of various kinds. Standard gage blocks, surface plates and accurate scales are useful. Good bench centers also have a place in many tool rooms.

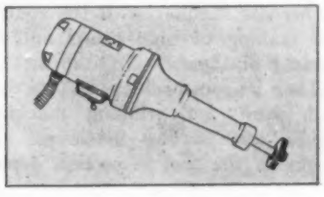
LIGHT WAVES for fine measurements are no longer a laboratory monopoly. There is now a light-wave micrometer for the tool room so that the toolmaker, or inspector, can duplicate readings within 0.00001 in. It combines light wave accuracy with the convenience and speed of the bench micrometer. It saves time and secures accuracy by insuring definite pressure in making measurements. It can also be used with



3-wire measurement of screws, taps and gages. It checks measuring wires and plug gages. It is almost indispensable in measuring such materials as paper, rubber, textiles, fine copper wire or other soft metals. The light wave bands show the pressure exerted by the micrometer screw. Each band indicates a pressure of 6 oz. By taking all measurements with the same pressure identical results are insured.

MICROMETER HEADS or indicating dials are built into many inspection and gaging fixtures. Both micrometer heads and dial indicators can be purchased from several well known makers. In addition there are available practically all of the separate parts that might be needed to connect them to the fixture that is being made. Every toolmaker and tool designer should know just what is available—and where.

HAND GRINDERS for use in the tool room to finish the inside of forming dies, or to relieve high spots that may interfere with the proper draw of the sheets, are not new. The early makers of flexible shafting made such grinders possible for the first time. Now the small electric motor is used for the same purpose

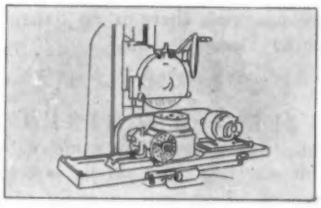


with the pliable rubber covered wires as the connection to the source of power. Advances in motor design and construction now make it possible to have motors that are light, reliable and convenient to handle right on the job. But the shaft grinders are by no means obsolete and have their good points. They are still made by some of the best people.

TURNING A RADIUS somewhere on the work is a job the toolmaker has to do every once in awhile. He can of course rig up his compound rest or some other device and get away with it. But when he can buy a radius turning attachment made specially for such work when it comes along, it saves not only a lot of fussing around with a makeshift that takes time and adds to the cost of the job. Such a device is now on the market for use on small tool room lathes.

ROTARY TABLES on small surface grinders are convenient on many jobs that come up in the tool room. Some call it a ring grinder table because this type was largely used for grinding the sides of piston rings at one time. One maker now puts out a small rotary table, driven by an independent motor, that can go on the table of any surface grinder and give the advantages of a rotary machine with a magnetic chuck.

In addition this device has an indexing head so that slots across the



face of a ring or other piece can be ground in correct position while the work is held on the chuck. They also make a portable exhauster for removing grinding dust from the work. Both are valuable accessories in the tool room.

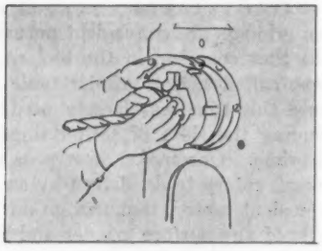
TOOLMAKERS, more than men in other departments perhaps, must distinguish between *measuring* and indicating. Micrometers of various kinds, gages with dial indicators,

gage blocks and the like, are all helps in measuring. After the tools have been made, as where plug gages are made in quantity, the indicating mechanisms can inspect them rapidly, and show whether or not they are within allowable limits.

These inspection instruments can be classed as comparators, as they compare with a standard and indicate the variation if any. Some of these are amazingly sensitive. In one such instrument a variation of 0.00005 in. moves the pointer over $\frac{1}{8}$ in.

Optical flats, for showing the flatness of gage surfaces, are also in fairly common use throughout the tool rooms of the country. All of which is an indication of the increasing attention being paid to accuracy.

QUICK CHANGE adapter arbors and collets are as convenient in the tool room as in small production work where drills, milling cutters or reamers have to be changed fre-



quently. Where the toolmaker is using first one tool and then another it helps a lot to be able to make the change in 20 seconds, or less, and once changed, there is no danger of coming loose.

FILING MACHINES have changed in many ways, some of them a bit startling. The old jig saw type, some of which use an ordinary file, and the rotary file have long done useful service.

Now we have the band saw type of filing machine in which sections of files are supported by a steel band, and file continuously. These band files can also be used on internal work and are very popular in tool rooms on die and similar work. Files of various shapes and cuts can be used and outlines can be followed very closely, and they cut very rapidly.

▼

Training Toolmakers

One large organization draws its men for toolmaker training from the production department. Likely young men with initiative and ability are selected for training in the tool room. Having a machine background and being familiar with the operation of at least some of the machines in the tool room, they require less training than the regular apprentice.

These men can do many of the simpler operations with little or no instruction. They must be taught to use such special tool room machines as the jig borer and die sinker, and the finer points of milling, lathe work and grinding. Knowing the necessity for extreme accuracy in the tools from their contact with them on production, they perhaps appreciate the instruction more than those without shop experience. These two factors mean that they should learn more rapidly. As one shop executive expressed it "they soon learn to take orders understandingly", which is not always the case.

Picked from School

Another company takes its learners direct from the high school. The boys must have high marks and show aptitude for mechanical training. They are interviewed and examined very carefully by men of wide experience and who have the faculty of getting on with young men. Sons of employees receive preference, other qualifications being equal, but it is preferred that father and son do not work in the same plant.

The boy is scheduled during the four year period so as to give him a thorough knowledge of the work. During his first five months he is given special assignments, all intended to give him a general knowledge of the work to be done, the shop routine and the like. He may act as helper to some good toolmaker so as to absorb knowledge of tool names, of shop practices, of the need for accuracy on some parts, and general information. He spends a month in the tool design department to become familiar with the routine, the making of blue prints and the reading of them.

Then he goes back to the tool room and works on grinding machines, lathes and milling machines. Six weeks in the tool inspection department follows to teach the need of accuracy and the tests through which the toolmaker's work must pass before it can go into service. Then follows four months in four different production departments during which he must meet production schedules. Here he gets first hand information as to requirements of the tools he is to make, the treatment they receive and the conditions under which they must stand up.

Heat treating comes next. Here he spends three months becoming familiar with the various furnaces and baths, and the way in which tools must be handled. Every tool specification includes the Rockwell hardness the tool must show on the testing machine that forms part of the heat-treating equipment.

Then comes a month in the gage making department, which of course trains the boy in the need for accuracy and the methods by which it is secured. Experience on machines devoted entirely to tool and fixture work comes from three months on the vertical shaper or tool room slotter and the Lucas type of boring machine used in jig and fixture work. Next comes seven months on jig work, which includes the jig borer and the many types of work it can handle, and a similar period on punch and die work, part of which is devoted to becoming proficient on the Keller die sinking machine.

Half Day a Week at School

During the whole four years the apprentice has had a half day a week at the city high school, the time being devoted to such mathematics as are useful in high-grade tool work, and other subjects of a similar nature. Shop trigonometry plays an important part in jig boring and similar work. These school sessions are so scheduled as to spread school attendance (and shop absence) in order that too great fluctuations in the size of the classes can be avoided.

After completion of the course the young man becomes junior toolmaker, at a very good rate of pay. Under normal conditions he is guaranteed at least a year's employment after graduation. As a matter of fact most of the boys remain with the organization and become group leaders and even more important shop executives.

Editorials

AMERICAN MACHINIST ESTABLISHED 1877
VOLUME 80 NUMBER 25
K. H. CONDIT • F. H. COLVIN
EDITORS

ANOTHER NRA?

ONE sure result of the Roosevelt landslide will be an effort to revive the NRA or to accomplish the same objective by other means. The nucleus of the old organization still exists and has been biding its time until after the election. The President himself still believes that federal control of industry is a desirable objective. Some business men and industrialists agree with him, at least to the extent that it affects their own industry.

Meetings will be held in Washington next week where Mr. Berry will endeavor to prove that he can pull employers and employees together in support of federal control of business. Whether or not we believe that such control has any merit for industry in general or for the various branches of the metal-working industry in particular is beside the point. We must keep informed of developments in this direction and take such part in them as circumstances dictate.

Organized labor will be in even a stronger position during the second Roosevelt administration than it was in before because of its united political support of Mr. Roosevelt. It was successful in putting clauses in the original NIRA that were largely responsible for its death at the hands of the Supreme Court. It was also successful in forcing through the Walsh-Healey government contracts bill intended to accomplish the same end. There is no reason to expect that it will have changed its attitude toward industry control in any particular.

In view of what happened to the old NRA, which was a proved failure before the Supreme Court knocked it out, the chances are that no attempt will be made to legislate general industrial control along similar lines. The approach may be through state laws with federal support for enforcement or through federal laws applying to individual industries. In either case the trade associations and the federations of trade associations must begin to crystallize the opinion of their respective members on the principle of industry control and do what they can to see that new legislation does not repeat the mistakes of the old.

INDUSTRIES where labor conditions are not what they should be will be well advised to put their own houses in order so that they may come into court with clean hands when their time arrives. Generally speaking, industrial relations in the metal-working industries are in better shape than in some other industries one might name, but there are individual companies and occasional groups that are distinctly vulnerable to attack by labor sympathizers. The trade associations to which these companies or groups belong owe it to their other members to do what they can to clean up these bad spots.

Used Machine Tools Are Scarce

TO THE many sound reasons for modernizing plant equipment another one has been added recently—the shortage of used machine tools. Why is it a reason? Because the displaced tools will bring a better price now than for some time.

It is not hard to discover why there is a seller's market in used machines. The feverish buying of any kind of munition making equipment, good, bad or indifferent, by warring factions and by countries that had allowed their defense programs to lapse, took a large portion of the American stocks of machine tools out of the market. More went to foreign buyers whose home markets were shut off by the defense programs.

Here in the United States the rising tide of recovery washed out the worst of the obsolete junk as profits made it possible to purchase sorely needed replacements. The big shops bought new tools and disposed of ones they had that no longer met their requirements but were still good enough for some of the smaller shops. The smaller shops snapped them up and got rid of the older units with which they had been struggling. Some of the programs included a certain amount of actual scrapping.

As a consequence the used machine market has been pretty well cleaned out, and prices are correspondingly good. It's a good time to do something about that modernizing program which has been hanging fire so long.

Chips

WASHINGTON —Tugwell resigns to accept vice-presidency of American Molasses Co . . . Business leaders accept responsibility for putting remaining unemployed back at work, wait word from Roosevelt before framing plans . . . President expresses disapproval of house-to-house census of unemployed, leans to Johnson plan of registration, urges hiring of idle workers who are past the 40-year mark . . . Berry tells A.F. of L. meeting that Supreme Court must become more liberal or else ways will be found to circumvent it . . . New type of smaller army division to be completely mechanized . . . Social Security blanks are delivered to employers and employees . . . Supreme Court upholds New York's unemployment insurance law, decision may presage similar attitude toward federal Social Security Acts.

FOREIGN—German - Japanese agreement believed to be another link in anti-Red movement started by pact between Hitler and Mussolini . . . Recognition of Spanish Fascists by Italy and Germany stirs premonitions in diplomatic circles . . . Soviet condemns German engineer to death on sabotage charge, adds to ill feeling between two countries . . . Dire need of foreign exchange leads Germany to decree the deposit of all German-owned foreign securities in foreign exchange bank . . . Spanish rebels declare blockade of Barcelona which is not recognized by France and England . . . Holland and Switzerland join U.S.-G.B.-France monetary agreement . . . Italy may reopen U. S. war debt question . . . England forbids her ships to carry arms to Spain . . . New Soviet constitution modeled somewhat after our own provides for two legislative bodies and represents a long step toward a democratic political set-up . . . Award of Nobel peace prize to German pacifist arouses furor in Nazi circles.

FINANCE—Excess bank reserves rise $10,000,000 more, adding to inflation threat . . . Weekly bank clearings largest in five years . . . Wall Street Christmas bonuses back at pre-depression levels . . . Senator Harrison envisions balanced budget in 1938, no more taxes . . . Internal revenue collections up one-sixth in first four months of fiscal year . . . Death of surviving Van-Sweringen raises question as to what will happen to the railroad properties controlled by him and his brother.

INDUSTRY —Bendix meets sit-down strike by closing plant and ordering men to turn in their tools, but more than 1,000 refuse to leave . . . A.F. of L. convention votes condemnation of unauthorized seamen's strike, boycott of clothing label of Amalgamated Clothing Workers (C.I.O. group), hears Howard threaten to pull printers out of Federation, upholds action suspending C.I.O. union . . . Brookings chief says further recovery will lead to labor shortages . . . Steel prices are advanced $2 to $4 a ton . . . Budd gets order for six streamlined trains for Rock Island . . . N. Y. Central orders 100 locomotives . . . Ford to spend $1,400,000 for machinery for Canadian plant.

TRADE—Foreign Trade Council at Chicago meeting endorses Hull's reciprocal treaties.

INDICATORS —Steel production remains at close to 75 . . . Carloadings up counter-seasonally . . . *Business Week's* index rises more than a point to 77.

America Celebrates 100 Years Of Patents, Honors Inventors

Peering into the future, scientists and industrial leaders predict fruition of fabulous dreams

Climaxed by the "Patented" dinner at the Mayflower Hotel, Washington, D. C., in the evening the celebration on Nov. 23 of the 100th anniversary of the founding of the Patent Office was an impressive ceremony from start to finish. At the morning session in the building of the National Academy of Sciences the speakers and their topics were:

Dr. Harrison E. Howe, Editor, *Industrial and Engineering Chemistry*, "Importance of Inventions to Civilization"; Hon. Thomas Ewing, New York, "The American Patent System"; Dean Dexter S. Kimball, College of Engineering, Cornell University, "The Great Inventions of the Century" and Dr. Robert E. Wilson, Vice-Chairman, Pan American Petroleum and Transport Co., "Looking Toward the Future of Invention."

In the afternoon at 2 o'clock, a "Research parade." planned by Watson Davis, director of Science Service and chairman of the program committee of the Centennial, displayed the newest developments of scientific research which have practical application in the immediate future. Using the technique of the newsreels and radio an off-the-stage voice carried the continuity between the various demonstrations.

The new fields of research demonstrated included television's electron tube applied to the microscope; polarized light and polarizing material which prevents blinding headlight glare in night driving; supersonics, sounds beyond the limit of hearing; lignin, the enigma of the forest; super hard glass and the production of glass textiles; the production of synthetic rubber-like materials having properties excelling those of natural rubber; the effectiveness of the body's glands as shown in animal experiments; solar power; new methods of electrical power transmission; and the testing of silk stockings by National Bureau of Standards scientists.

A hundred years in the progress of lighting was summarized Monday night at the "Patented" dinner concluding the celebration. Guests at the banquet witnessed the greatest display of lighting that has ever been shown publically within four walls. Total electrical power used to run the display at its peak brilliance was 60,000 watts.

The story of illumination from candles to the newest electric lamps which provide light rivaling that of the sun was shown in a dramatic sequence in which the persons attending the dinner were carried swiftly from 1936 to the present.

The large ballroom of the Hotel Mayflower was illuminated first by tallow candles such as those which were the only source of light for such affairs in the presidency of Andrew Jackson. Immediately the chairman of the celebration, Dr. Charles F. Kettering, president of General Motors Research Corp., with a wave of his hand before a sensitive photo-electric cell, transformed the room into a brilliantly lighted scene in which the group attending the dinner saw each other as under a noonday tropical sun.

Lights used for the decorative illumination demonstrated a use of colored illumination which has never been possible before with the same efficiency, using a development which has not yet been made available for general consumption.

The colored lighting effects demonstrated at the dinner are made possible by a new fluorescent lamp, still in the laboratory stage of development, which emits from 50 to 200 times as much colored light as ordinary colored incandescent lamps. The lamps contain a trace of mercury, a small amount of argon gas, and a special fluorescent powder which clings to the inner surface of the glass bulb. When the lamp

▲

WORLD FAMOUS

because it was the basis of the most vigorous litigation in American patent history, Selden's automobile patent controlled the early destiny of the automotive industry. Henry Ford refused to accept the broad claims, led a long fight to free the industry of the broad claims, and is credited with the successful move to "pool" automobile patents among manufacturers

▲

2 Sheets—Sheet 1.

G. B. SELDEN.
ROAD ENGINE.

No. 549,160. Patented Nov. 5, 1895.

Fig. 1.

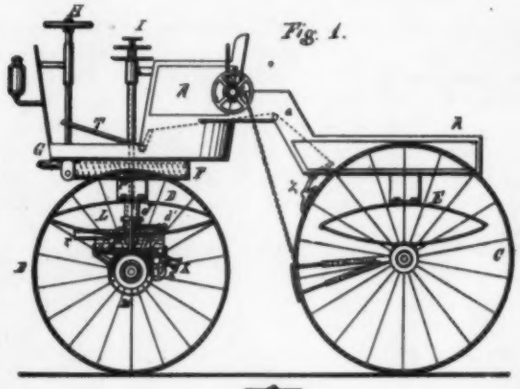
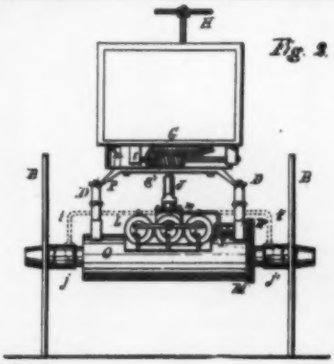


Fig. 2.



WITNESSES
Wm. Whitney Jr.
Geo. Eastman

INVENTOR
Geo. B. Selden

"FATHER" of the U. S. Patent System, Senator John Ruggles, Maine, introduced legislation in Congress more than 100 years ago setting up the system very much as it is today. He was granted the first patent, a "traction wheel for locomotives" on July 13, 1836, listed as Patent No. 1

is turned on the argon automatically acts as a starter and in a few moments a feeble, blue light and a large amount of invisible ultra-violet radiation is generated. The ultra-violet radiation strikes the fluorescent coating and is transformed into visible colored light. This transformation results in the great gain in efficiency over present colored light bulbs.

The lighting exhibit also displayed a new "capillary" electric lamp or small size which produces a brilliance exceeding that of the sun and emits a wealth of photo-chemical rays useful in commercial applications and in healing some sicknesses. Pressure inside these tiny lamps has been raised to several tons per square inch and under such conditions the brightness of the light exceeds that of the sun.

Gordon Hittenmark, National Broadcasting Company commentator riding in an Eastern Air Lines plane, and speaking as the "Voice of Progress", described the gathering as "a great conclave of America's men of science, invention and industry gathered to celebrate the 100th anniversary of the American Patent System.

"This system has served as a model for the world and made possible unified, coordinated progress toward happier living for all peoples", he added.

With a joint hookup between the airplane broadcasting station and the banquet hall, the radio presentation described the introduction of Conway P. Coe, patent commissioner, by Mr. Kettering, and the introduction of the Hon. Secretary Daniel C. Roper by Commissioner Coe.

Immediately following the audience and radio listeners heard the original telegraph message "What Hath God Wrought" transmitted from Baltimore to Washington as it was on May 24, 1844 by Samuel F. B. Morse, inventor of the telegraph, and the receiving instrument was the same one which Morse used.

They also heard the voice of Thomas Alva Edison speaking through one of his own sound-recording inventions.

Returning to the airplane to introduce Dr. Kettering at the conclusion of the ceremonies. Hittenmark declared that the spirit of the inventors honored in the centennial celebration of the American patent system lives on. "As we wing onward they seem to whisper 'I am the voice of progress. I will be heard.'" he declared. "In a world of constant change I alone will not change. My voice must be heard by you—by your sons and the sons of your sons as long as man exists. What I will say as time rolls on no man can confidently predict, but I have given hints.'"

Guests at the patented dinner dined on "fresh meats, fruits and vegetables" which are from two months to a year old. The menu of the patented dinner is made up largely of Frosted foods prepared according to a patent awarded about six years ago and now controlled by the General Foods Corporation of New York City. The patents represent man's most recent advance in the oldest and most essential of human activities—guaranteeing a food supply.

The lobsters for the cocktails were killed in Boston Aug. 10. Red perch for the fillets were caught July 14. Turkeys which constitute the chief part of the meal were killed at Fort Wayne, Ind., Dec. 5, 1935. The raspberries for the raspberry puree were picked in Hillsboro, Ore., Aug. 17. The lima beans were picked in Bridgeton, N. J., Sept. 9. Corn was gathered from the garden in Medina, N. Y., Sept. 16 and the squash was picked in Hillsboro, Ore., Nov. 13. The asparagus tips were growing in a New Jersey field April 19, and strawberries were picked in Oregon June 24.

They were not canned. They were not preserved in cold storage. They are literally "fresh".

Even the cocktails and wine at the dinner were patented. The former was patented as a hair tonic, "guaranteed to grow hair on bald heads," but its chief ingredients are corn whiskey, port wine and currants in appropriate cocktail proportions. The wine was sherry made by a process upon which a patent application is pending.

The souvenir program of the dinner was a formal replica of a regular patent, being number 10,000,000, signed by the Hon. Conway P. Coe as "Commissioner of Patent Dinners," tied with red, white and blue ribbon, and carrying the great red seal of the U. S. Patent Office.

Liberties taken with the formal language of the patent office, designated No. 10,000,000 as "an alleged new and useful improvement for beverages, edibles, comestibles, digestibles, suggestibles and antidote for any beverage" and granted the executive committee of the patent office celebration "the exclusive right to compound, serve and enjoy the said invention throughout the United States and its territories and the known universe."

Menu Items Numbered

Items on the dinner menu were designated by the numbers of the patents received for each and the actual name of the hair tonic cocktail, consomme, "Ye Olde 'Pat' Pending" wine, turkey and other items were printed in type too small to read except with the aid of magnifying glasses made of "Pontalite," a new organic glass, furnished by the E. I. du Pont de Nemours company.

Additional humorous note in the dinner menu and program was the testimonial from the late Andrew Carnegie for his 1905 Winton motor car. "We are very pleased with our new Winton," wrote Mr. Carnegie in 1905, "From the very start it has done its work and never failed us. There may

be improvements yet to come but it is difficult to see much room for them."

Asked by *American Machinist* to name the ten most important patents in their respective fields, presidents of the American Society of Mechanical Engineers, National Machine Tool Builders' Association, Society of Automotive Engineers and the American Society for Metals found a great deal of difficulty in deciding which of the large list of important American inventions had been most outstanding. This, they pointed out, was due to the complexity of mechanical devices and machines in use today, most of which employ ideas of numerous inventors.

Clayton R. Burt, president of the National Machine Tool Builders' Association wrote:

Cites Great Expansion

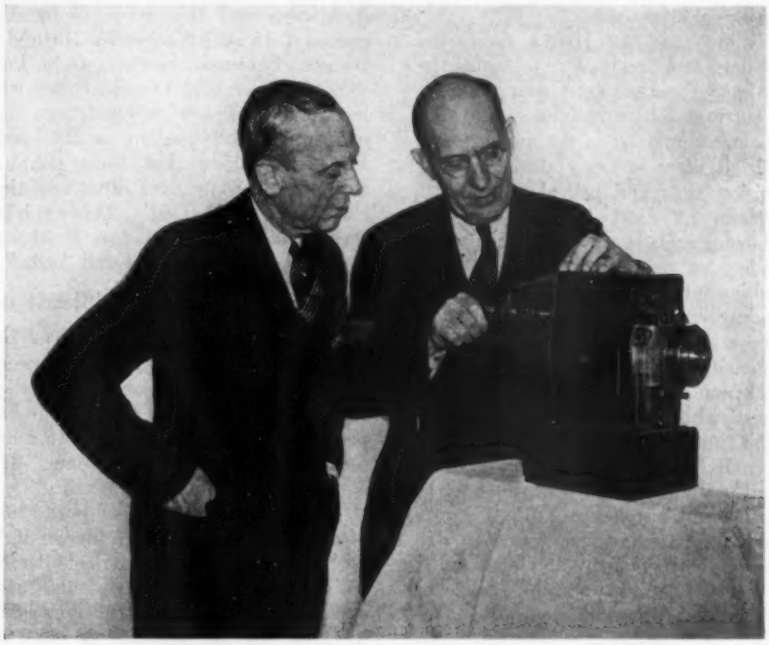
"Under our patent system the greatest industrial development and expansion ever known to man has taken place. In great part this growth can be directly attributed to the incentives offered inventors by giving them for limited times the exclusive use and enjoyment of their inventions.

"Since 1790 our constitution has permitted patents to be granted for the purpose of promoting the progress of science and useful arts. In 1936 a system of examining the novelty and utility of inventions by a corps of technically trained personnel was adopted. This system during the past 100 years has been improved but never modified to any appreciable degree.

"It is fitting, therefore, at this time that we look over the patents granted for improvements in machine tools. It is upon the development of machine tools that many other industries have depended for their development and to which their present magnitude is responsible. Our entire industry has developed during the past century. From such men as Eli Whitney machine tools had an early start but it was not until the thirties and forties that one could say that an industry was in progress of development.

The Early British Developments

"The engine lathe, planer and boring machine had been developed in Great Britain. It remained for our own country to develop and perfect the milling machine, create gear making machines and perfect equipment for the mass production of duplicate parts to the closest possible precision. This development is an ever continuing one and no ultimate limit of accomplishment can be even guessed at.



and "SON" — **although no lineal descendent, Charles F. Kettering is carrying on the traditions of Senator Ruggles and the host of inventive geniuses who pioneered ideas, which as much as natural resources, have made this nation great. Mr. Kettering, right is shown with Alfred P. Sloan, Jr., president of General Motors Corp., examining the first self-starter for automobiles. He was chairman of the Patent Centennial Celebration, is famous for his restless, inquiring mind and inventive ability**

"In the development of machine tools since 1836 several patents stand out as exceptional. Some show crude machines the essential members of which have their easily recognized counterparts in our modern machines which have developed from them. Others show machines which since their original model was made have been continued without substantial modification except for the necessary increases to the strength and rigidity of their parts and their speeds of operation. All of these patents show machines of basis originality, the features of which are still to be found in our most complicated modern automatic high production tools. To keep up with the endless improvements in alloy cutting tools and the demands for production at high speed as well as extreme precision and at low cost has been the continuous challenge to the machine tool engineer.

"The following patents taken from those granted during the past one hundred years by our Patent Office have been selected as among the most important of those relating to machine tools.

"Robertson 9307 (1852) shows the first milling machine patent of the type which later became known as the Lincoln type miller. Many thousands of these were built at Hartford and used throughout the world.

"Brown 46,521 (1865) shows the original patent for the knee type of universal milling machine which is still one of the most useful tools in any machine shop.

"Spencer 223,255 (1880) shows one of the earliest automatically operating machine tools. This is the forerunner of innumerable machines of this type built over a long period of time and known as the Hartford Automatic Screw Machines.

"Bilgram 284,844 (1884) discloses an early machine for accurately forming bevel gears upon a generating principle to give proper conjugate action to the teeth of mating gears. Its principles are as sound today as when the first bevel gear generating machine was built.

"Sponsel 446,898 (1891) shows a machine which, without any substantial modification, has been used for rifling the barrels of small calibre firearms since it was developed and which

promises to continue to do so for many years to come.

"Fellows 686,599 (1901) shows the machine first built for forming the well-known pinion type gear generating cutters. The principles of this machine are employed in the modern gear tooth grinders recently developed for precision spur and helical gears.

"Heim 1,210,937 (1907) shows the first commercially developed centerless grinder for cylindrical surfaces. This machine introduced a new principle of grinding which has rapidly found a place and has continuously gained in popularity and usefulness.

"Hanson 1,323,267 (1919) shows a precision boring machine by means of which jogs, fixtures and parts made in small lots or singly can have holes bored with extreme precision as to spacing and parallelism. By this machine the attainment of precision was possible both rapidly and uniformly.

"Shaw 1,683,581 (1928) describes a completely automatic milling machine for reproducing in steel irregular shapes of any contour or outline from a wooden model. This machine has been adopted almost exclusively for the making of blanking, cutting, forging and forming dies of all types and sizes.

Basis of Huge Business

"Upon the principles of operation disclosed in the above short list of patents, many millions of dollars of business have been done. The list is by no means complete but is representative of some developments within our own country and industry and which have advanced the art of metal cutting and grinding to its present high state of efficiency."

William L. Batt, president of the American Society of Mechanical Engineers, after an extensive investigation, submitted the following:

"Realizing fully that criticism will be made of the following list, because no list where judgment enters into the selection can ever be approved by everyone, it is hereby submitted with two extra names for good measure.

Howe	.....	Sewing machine... 1845
Hoe	.....	Rotary press .1846
Hunt	.....	Safety pin ...1854
Sholes	.....	Typewriter ...1867
Westinghouse		Air brake ...1868
Janney	.....	Car Coupler..1873
Edison	.....	Phonograph, etc... 1877
Pelton	.....	Water Wheel..1888
Burroughs...		Recording Adding Machine.1888
Mergenthaler		Linotype 1890
Gayley.....		Dry air blast furnace 1894
Harvey		Harveyized steel... 1891

"Arbitrarily the list includes only Americans and this accounts for the omission of such names as Nasmyth, Bunsen, Bessemer, Siemens, Otto, Parsons, Daimler and Diesel. Other well known names are omitted, not because they do not belong on the honor role, but rather that their nominations should come from other societies, chemical, electrical, etc. This explains the omission of such names as Morse, Bell, Thomson, DeForest and Tesla."

Finds Selection Difficult

Ralph R. Teetor, president of the Society of Automotive Engineers, found that the further he studied the question of which ten automobile patents had contributed most to automotive development the more difficulties he encountered.

"The automobile is a composite unit of almost every generally known form of mechanical and electrical device. This makes it such a complicated structure that it is quite impossible to say just what influence patents may have had on the various parts.

"Few important patents have been taken out on the automobile as a structure, and those that have been issued have probably had very little influence on the actual development of the car itself.

"A review of the list of component parts, on the other hand, discloses literally thousands of patents that have influenced the automobile as we know it today. I am personally unable, I am afraid, to select ten and say with any assurance that they have contributed most to automotive development."

Significance of System

Edgar C. Bain, president of the American Society for Metals, found the same difficulty in making a list of the ten outstanding patents in his field. He wrote:

"It is appropriate that the American Society for Metals, together with other technical societies, should offer hearty felicitations to the United States Patent Office on the 100th anniversary of the significant events of 1836 establishing the American Patent System. In such commemorations opportunity is given to appreciate anew the benefits of wise and provident human effort in the past and to cherish our familiar institutions more nearly in proportion to their great worth.

"The Constitution of the United States empowers the Congress 'to promote the progress of science and useful arts by securing for limited times to authors and inventors the exclusive rights to their respective writings and discoveries.' The American Society for Metals devotes itself to the promotion of the arts and sciences of manufacturing and treating metals. The similarity of these declarations is neither superficial nor fortuitous. A group with a common interest in the manufacture, sale or use of metals has occasion to be deeply interested in the rights of inventors assured under a good patent system.

"The trained technologist in metals and the layman alike must surely find a source of interest in the contrast between

1. The *natural* right of an inventor merely to make, use and vend his invention and to deprive the public of its benefits by keeping it a secret, and
2. The *exclusive* right to benefits of his invention granted, for a definite period by a sovereign authority in exchange for a complete public disclosure.

"We may well be glad that Congress was inclined to exert its power to encourage inventive effort by providing the forthright contract implied in letters patent.

Patents Poorly Drawn

"It has been said that most patents which ultimately find their way into litigation are poorly drawn. The inventor, however, must feel equally disappointed if it should ever happen that his patent became involved in litigation because it was poorly examined.

"The art and science of metals have progressed at unparalleled rate in the last few decades; the art of invention is here superimposed upon a formidable body of science, extremely complex and rapidly growing, taking some component from most domains of physics, chemistry and engineering and encompassing a singularly difficult field in physical chemistry relating to the solid state of matter. It is essential to the successful operation of the American Patent System that the examiners in divisions engaged with metallurgical applications be well versed in this curiously diversified field.

"May not metallurgists properly concern themselves with the continuance of highly trained specialists in this exacting work of patent examination, insured by adequate recognition of the high degree of proficiency in the sciences requisite in a rapidly expanding field. And may it not be that the Patent Office offers today a most attractive career for the outstanding technical graduate who has some aptitude for the law and a native understanding of the nature of invention."

Watching Washington

Berry proceeds with conference plans . . . President's interest is in doubt . . . A. F. of L. advocates 30-hour week . . . C. of C. estimates industrial unemployed . . . Harvester may provide key labor case

WASHINGTON—Away attending Buenos Aires' Inter-American Peace Congress, the President has left promulgation of New Deal domestic policies to his lieutenants. Most active among these is Pressman's Union Head and Federal Industrial Coordinator, Major George L. Berry. Failing to take the discordant note out of the A. F. of L. convention at Tampa, the Major again turns attention to his plan for a "truly representative" conference of industry on December 10-11.

How representative the meeting will be depends on how far business leaders will be in joining with the Major. In facing the common problem of further reducing unemployment, industry is ready and willing to cooperate with the administration. The big question in industrialists' minds is how far the President backs the Berry program. From a similar conference last year, business men stayed away in large numbers, leaving the ensuing Industry-Labor Council greatly lopsided on the labor side. They contended, and still do, that as a dyed-in-the-wool trade unionist, Major Berry is hardly the man to head a group ostensibly seeking an impartial approach to labor problems.

Not strongly interested, sources close to the White House assert, the President still feels friendly to Berry, appreciates his campaign efforts. Berry was an unlisted White House caller just before the President's South American trip.

Some Substitute Wanted

Perhaps the truth is that Roosevelt has not made up his mind on the course he wants to pursue. He does desire some kind of a substitute for achieving NRA's aims but has made no commitment whatever. While Berry's meeting may serve as a convenient trial balloon on industry's attitude, it will prove nothing in particular about the President's plans.

The opening date of the conference overlaps the annual meeting of the National Association of Manufacturers. Since many of the more prominent recipients of the Major's 3,700 invitations will probably attend the N.A.M. sessions, it seems apparent that the conflict in dates was unintended. However, it is unlikely that business will ignore the Berry conference. Representatives may be selected to attend the first day with a show of greater force on the 11th.

Chief fear of industry is being jockeyed into a position of seeming to support a program to which it is definitely opposed. It has not forgotten Berry's part in the Tampa convention at which the A. F. of L. announced, as its "paramount objective," the six-hour day and five-day week. Recalled, too, are his words before the same body attacking the "present philosophy" of the U. S. Supreme Court and suggesting that a way be sought to "make liberal legislation stick."

Hopkins Suggest Short Week

Another New Dealer, Public Works Administrator Harry L. Hopkins, previously advanced the short-week solution to the job situation. Before the U. S. Conference of Mayors, held in Washington, Hopkins stated that labor-saving machinery and the annual influx of 500,000 young persons of work age made necessary the arrangement of shorter hours for active workers.

Meanwhile under the chairmanship of John W. O'Leary, the Special Committee on Employment of the U. S. Chamber of Commerce has come to certain conclusions. Admitting the inadequacy of factual data, the committee places at less than 4,000,000 the number of persons who if employed would find their places in business and industry. This figure includes those now on government relief work but has no reference to unemployed farm labor or the unemployed among professional classes. Among its recommendations the committee concluded that:

"Projects for work-relief should not be permitted to compete in any degree with private enterprise for workers skilled or unskilled, and should be so conducted as to encourage workers to seek private employment.

"There should be immediate expansion of facilities in the states and communities for young people, and for workers desiring to increase their skill, to obtain training. . . ."

Another business group was heard from when Secretary Roper's Business Advising Council, through its Committee on Social Security, urged all employers to cooperate with the Social Security Board in assigning old-age benefit account numbers to some 26,000,000 employees. Heading the committee is M. B. Folsom, treasurer, Eastman Kodak Co.

Findings of the National Labor Relations Board in the International Harvester case have unusual significance. The order to disestablish the "Harvester Industrial Council Plan" may be the basis of a key case. If upheld in the courts, the boards findings may make company unions a thing of the past. Noteworthy in the ruling is the amount of space given arguments tending to show that manufacturing is an interstate activity.

First labor relations cases slated to be decided by the Supreme Court are likely to be won by the government. Bus cases, and even the Associated Press case, involve activities that may be regarded as interstate. Months will probably pass before reaching a clean-cut case raising the issue as to whether manufacture is local or interstate.

Walsh-Healey Regulation

To restrict a loophole, whereby goods produced under less than Walsh-Healey standards might be sold the government, Secretary Perkins has issued a new regulation holding that when dealers fulfill contracts for government purchases subject to the Act by direct shipment from the manufacturer, rather than from their own stocks, they are merely acting as manufacturers agents. In such cases, the regulations will apply not only to the dealer but to the manufacturer as well.

Liquidation of the Reconstruction Finance Corporation under Treasury auspices is said to be in the minds of officials. They believe recovery has advanced to a point where continuation of the RFC as a separate entity is no longer necessary.

Air Line Increases Order For Engines

Pratt & Whitney Schedule Nearly Tripled by United

United Air Lines has increased its original order of 26 Pratt & Whitney 14-cylinder Wasp engines to 68 as a result of successive increases in the number of Douglas DC-3 14- and 21-passenger transports ordered by United since last Spring, W. A. Patterson announced recently. Pratt & Whitney engines are rated 1,000 horsepower with 1,150 maximum available horsepower.

The engines now being installed in United Air Lines' new $3,000,000 fleet of 28 Douglas planes for its New York-Chicago-Pacific Coast route, were purchased after competitive tests in one of the new 12-ton Douglas ships.

United's new Douglas planes will use only 62 per cent of available engine power when cruising at more than three miles a minute and a range of 1,500 miles.

Heads DeSoto Manufacturing

HERMAN L. WECKLER

In charge of building the new $5,000,000 DeSoto plant, HERMAN L. WECKLER has been appointed vice-president and general manager of DeSoto Motor Corp., BYRON C. FOY, president, announced. He will be in full charge of manufacturing at the company's new Wyoming Avenue plant, Detroit. He joined Chrysler in 1932, having been works manager of Buick Motor Co.

Industrial Review

• MANUFACTURERS of machinery, with few exceptions, find inquiries active, orders abundant. Insistent domestic demand augmented by foreign sales, have made the problem of some shops not how to get business but how much of their capacity to reserve for old customers. Two factors account for the anxiety of buyers to place orders. First, rising wages and material prices foreshadow further boosts in machinery prices. Second, equipment users, despairing of better deliveries, are planning longer term replacement programs. Only fly in the ointment is labor trouble, and this not from the regular employees who are profiting from the increased activity but from outside organizers eager for their cut.

• NEW ENGLAND is one of the few sections reporting a slight slowing down but even here orders are maintaining a satisfactory volume. The New York district is running ahead of October which was an excellent month. Demand is well diversified. Both orders and inquiries continue to be good in Philadelphia. There are signs of labor unrest in the Quaker City with a department store strike in progress but this has not spread to metal-working plants.

• FROM PITTSBURGH comes the report that orders are holding up to the year's average with inquiries still coming in. The machine tool salesman is a welcome caller these days. November business in Cincinnati showed an improvement over preceding months, and in many shops, was the best of the year. With the Remington Rand plant closed no other strikes are threatened. Some Cleveland shops show a slight recission, but businses in general seems to be on the uptrend. Despite the breaking in of special leaners, skilled labor is scarce. Wages and material prices are booming, and it looks as though higher costs will force machinery builders to join the procession.

• DETROIT demand has advanced with car companies signaling full speed ahead. Shop supply divisions are busy, and inquiries indicate that this condition will spread to manufacturing equipment. Chicago's November bookings exceeded those for October. Outside of the recent Bendix strike at South Bend labor prospects seem sound. Still on the upgrade, Milwaukee finds November 30 per cent better than September or October. A fair rate of buying continues in Indianapolis. St. Louis looks toward closing a lot of live inquiries before January 1. Small tool orders are particularly active. An epidemic of strikes has brought about a temporary setback on the Pacific coast. Even so volume is better than last year.

Locomotive, Car and Steel Buying Nears 6-year Mark

Best Year Since 1930 Seen By Iron & Steel Institute

Buying of locomotives, cars and steel by railroads this year probably will reach the largest total for any year since 1930, the American Iron & Steel Institute said last week.

"During 1935," the institute said, "the railroads are estimated to have taken 6.5 per cent of the total steel output, the lowest percentage on record. For the five years from 1922 to 1926, similar estimates indicate that about 25 per cent of the steel produced was purchased by railroads, but the percentage has declined more or less steadily since that period.

"Orders for locomotives, exclusive of specially designed power units for streamlined trains, reached a total of 180 in the first ten months of 1936, compared with 83 for the whole of last year.

"In addition, inquiries are outstanding for 155 additional locomotives, while plans for the purchase of five more have been announced.

"Freight-car orders have shown a similar increase, the total through October reaching 38,664, as against 18,699 for all of 1935. During 1930 freight-car orders totaled 46,360. Inquiries are outstanding for 2,300 freight cars, with 3,300 more under consideration.

Spur To Army Aircraft Buying Is Expected Soon

President Will Recommend Increase For 1938, Officials Believe

A recommendation that the War Department appropriation for army airplane purchases be increased for the 1938 fiscal year probably will be made by President Roosevelt when he submits the new budget to Congress in January, it was indicated in army quarters following an announcement that the War Department has awarded a $3,429,600 airplane contract to North American Aviation, Inc., Englewood, Calif. The contract was for about 120 planes.

Motors AND OTHER MATTERS

Ford again makes news . . . Good machinery buying in the offing . . . Bendix strike threatens parts supplies, scares car manufacturers . . . Automobile market is brightest in years, December looks like 500,000-month

BURNHAM FINNEY
Western Editor

DETROIT—Ford again headlines the news. Ford officials feel that 1937 will be a Ford year and accordingly are understood to be in the midst of a machinery buying program to enlarge output at the Rouge plant. Rouge is tooled up to build 5,200 units in 16 hours (Ford operating usually on two eight-hour shifts five days a week). This will be expanded so that 7,000 units can be produced in that period.

Equipment is being bought to increase capacity of the 60 or economy V-eight from 1,200 to 2,000 units in 16 hours, while the production of the 85 is being stepped up from 4,000 to 5,000 units. Ford is hoping to have the new equipment installed within 10 to 12 weeks after orders are placed.

Expansion at Ford of Canada, Ltd., is announced. About $1,700,000 will be spent in enlarging the main production plant at Windsor, $1,400,000 to go for new machinery.

Only the Beginning

These two major programs by Ford are believed only the beginning of extensive machine tool buying by motor makers in the months ahead.

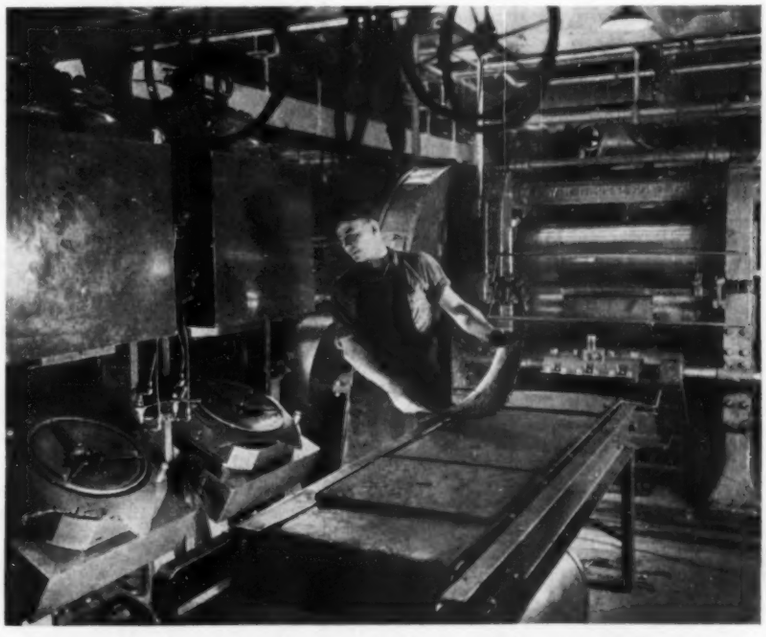
With the industry past the show period, 1938 is beginning to be talked about. It is a little early to tell what it holds in extensive tooling programs, but this much can be said. Automotive executives are convinced that both 1937 and 1938 will yield bumper crops of sales. So long as the buying wave continues, radical changes in design appear improbable.

On the other hand, lush earnings encourage motor companies to spend for modernization and equipment builders should benefit. Tooling programs for '38 seem likely to get under way early, probably in January or February.

What happens among the Big Three in 1938 depends largely on Ford's success with its economy car. If the 60 series clicks with the public, Chevrolet and Plymouth probably will rush development of small-motored cars. That would mean prodigal outlays for equipment. Under the circumstances machine tool people may well keep their attention glued on these two makers. Plymouth incidentally is going in for much wider activities in commercial cars and trucks the coming year. The situation may arise in the next 12 months whereby Plymouth and Dodge, both Chrysler divisions, are competing against each other for commercial business. In that respect they would be taking a leaf out of General Motors book, since Chevrolet and General Motors Truck have long been friendly (and sometimes not so friendly) competitors.

Overshadowing most problems at the moment is the labor situation. The Bendix strike, settled on Nov. 25, threw a scare into the industry and brought about a change in the plans of some companies. Packard was closed for a day or two because it couldn't secure Bendix parts and the story is that it is hastening a program for diversifying its parts sources. Cadillac, having escaped by its eyebrows a shutdown similar to Packard's, has transferred its carburetor business from Bendix to Carter at St. Louis. Buick in the emergency is said to have resorted to Marvel for carburetors. Ford, which is reported to get a considerable percentage of brakes from Bendix, is buying new machinery to increase brake output at the Rouge plant.

Chevrolet and Fisher plants at Atlanta have been down a week because of a strike precipitatel by the discharge of five workers who insisted on wearing union badges contrary to a long-established company rule. Fisher's plant No. 1 at Flint recently is understood to have experienced a four-hour "sit-down" strike which union officials claim has resulted in the United Automobile Workers getting a new lease on life in Flint. Union fortunes there had been pretty low for months. The U.A.W. says its membership now totals 90,000 to 100,000. Dues are $1 a month and initiation fee $1. The national organ-



Wheels of Plasic—Operator molding Ford steering wheels in part of battery of special presses at Rouge plant. Material rolled into small, square blankets, is taken by operator from conveyor and placed in press.

ization gets 37½ cents of each $1 of dues, the remainder going into the local's treasury.

The U.A.W. has 103 locals. All locals in General Motors plants send delegates to a General Motors Council which acts as a board of strategy and research committee. In Detroit the union claims special strength in the Dodge main plant, having taken over in recent months the former so-called Coughlin union there. Only at the Ford Motor Co. do union officials admit frustration. The U.A.W. has gained considerable strength since Homer Martin took over the presidency from the discredited Francis J. Dillon last spring. He is a loyal follower of John L. Lewis, while Mr. Dillon was an adherent of William Green. It seems to impartial observers that the automobile industry is in for a period of labor difficulties, possibly with a plague of sitdown strikes and other harsasing experiences. General Motors recently has gone to a 40-hour week with time-and-a-half for all work over that amount, one of the union's objectives.

Union workers at Midland Steel Products Co., Detroit, began a sitdown strike Friday night, occupying the plant. Leaders announced they will stay there until Christmas if necessary to get what they want, which is higher wages and more pay for overtime. Midland makes frames for Chrysler division.

Public Response Overwhelming

Public response to the automobile shows has been so overwhelming that all car makers are running full tilt in an effort to catch up with orders. Chevrolet delivered at retail about 100,000 cars in November and entered December with over 80,000 unfilled orders. Its December schedule tentatively calls for 120,000 cars, with 130,000 set up for January. The Atlanta strike just now is preventing Chevrolet from maintaining a pace of 6,000 units a day. Chrysler is heading for 120,000 units during December, an all-time record. There is scarcely a company which isn't hitting close to record volume for this time of year. November assemblies for the industry probably were about 425,000, while the December total should be around 500,000.

LIBBY-OWENS-FORD TO SPEND $150,000

Plant and machinery costing $150,000 is an additional step in a major modernization program announced by Libbey-Owens-Ford Glass Co., Toledo.

Heads New England Council

JAMES W. HOOK

A leading industrialist and president of the Geometric Tool Co., New Haven, Conn., JAMES W. HOOK, was elected president of the New England Council, Nov. 20, at the annual meeting of the organization in Boston.

From 1916 until 1923 he was president of the Allied Machinery Co., New York, when he acquired the controlling interest in Geometric Tool. He has been active in civic, industrial and philanthropic activities for years, and served the New England Council as a member from 1929 to 1932, and was industrial committee chairman of the organization from 1930 to 1932. In 1931 and 1932 he was a member of President Hoover's national committee on unemployment relief.

Prof. Arthur Talbot Wins Science Award

The 1937 John Fritz Gold Medal for notable scientific or industrial achievement has been awarded to Arthur Newell Talbot, professor emeritus of engineering of the University of Illinois, it was announced Nov. 22.

The citation accompanying the medal described Professor Talbot as "moulder of men, eminent consultant on engineering projects, leader of research and outstanding educator in civil engineering." The award is made annually by a board composed of sixteen past presidents of the four national societies of Civil, Mining and Metallurgical, Mechanical and Electrical Engineers.

Manufacturers Studying Re-Employment Policies

National Association Has Named Committee, C. M. Chester Says

Manufacturers of the nation will agree with President Roosevelt's suggestion that industry do everything possible to re-employ workers above 40 years of age as a part of the re-employment program toward which we are all striving, according to C. M. Chester, president, National Association of Manufacturers.

"It is true, as the President states, that skilled workers have been the first to find their way back to private employment. Reports from many trades, industries and communities already show a shortage of skilled workers.

"Based upon surveys which have been made, there is every indication that unemployment in America today is well below the 5,000,000 mark. The manufacturing industries have been the first to take up the unemployment slack and employment in these industries today is above 90 per cent of the 1929 level. It is increasing all the time.

"Our Association is now making a survey of its membership in connection with its Congress of American Industry to be held Dec. 9 and 10, and from this we hope to develop additional information on the amount of manufacturing employment," he said.

October Employment Broke 6-Year Record; Payrolls Up

222,000 Returned to Employment, U.S. Labor Bureau Reports

Employment in industry reached a higher level in the month ending Oct. 15 than at any time since 1930, Secretary Perkins announced last week. There was a correspondingly sharp increase in total payrolls.

"It is estimated that 220,000 workers were returned to employment in the combined manufacturing and nonmanufacturing industries surveyed monthly by the department's Bureau of Labor Statistics," Miss Perkins said.

"Aggregate weekly payrolls in October were $16,300,000 greater than in the preceding month. A comparison of employment and payroll totals in these industries in October, 1936, with October, 1935, shows increases of more than 1,000,000 in number of workers and $41,800,000 in weekly wage disbursements.

PERSONALS

JOHN T. BROWN, works manager, Chain Belt Co., Milwaukee, Wis., has been elected vice-president. He joined the company in 1925.

B. M. BROWN has been appointed assistant general superintendent of motive power of the Pacific lines of the Southern Pacific Railroad, with headquarters in San Francisco. He was formerly chief assistant superintendent of motive power of the Texas & New Orleans Railroad.

J. M. CLARK, formerly shop engineer, Canadian National Railways, Transcona, Man., has been appointed inspector of tools and machinery of the railroad system with headquarters at Winnipeg, succeeding W. E. SILER, retired.

DAVID DASSO has been elected vice-president of the American Locomotive Co's. diesel engine division.

JOHN L. DAVIDSON, formerly mechanical engineer of the Valve Pilot Corp., New York, has been elected vice-president.

KING HATHAWAY, consulting engineer, has opened offices at 1006 Merchants Exchange Bldg., San Francisco, where he will specialize on organization and management problems.

NORMAN B. JOHNSON has been appointed assistant chief engineer in charge of mechanical engineering of all plants of the Pullman-Standard Car Mfg. Co., Chicago. He was appointed production superintendent of the Michigan City plant of Haskell & Barker, recently acquired by Pullman.

CHARLES F. KETTERING, president of General Motors Research Corp. and a vice-president of General Motors Corp., has been elected a director of the National Cash Register Co., Dayton, Ohio, where he was an employee early in his career.

GEORGE B. MAGRANE has been elected vice-president in charge of manufacturing and a director of Oak Screw Products Co., Hillsdale, Mich. He was formerly a manufacturing executive of Chrysler Corp., Detroit.

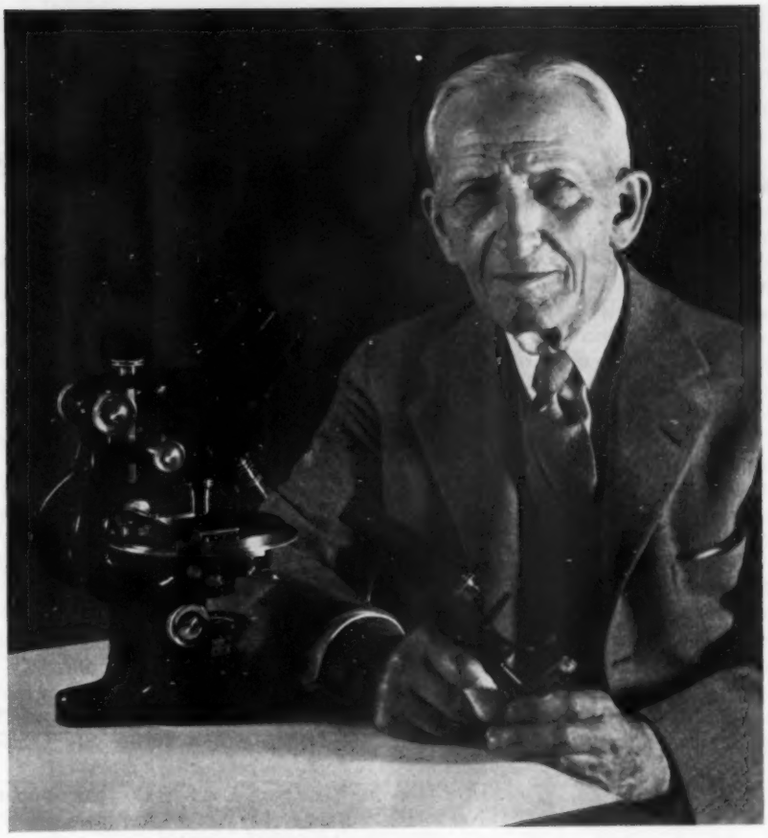
THOMAS J. MCLOUGHLIN has been appointed assistant to the vice-president in charge of operations, Carnegie-Illinois Steel Corp.

FREDERICK SALDITT has been appointed vice-president of Harnischfeger Corp., Milwaukee. He joined the company thirteen years ago as a mechanical engineer. He will retain supervision of foreign operations of the company.

THOMAS J. SKILLMAN has been appointed chief engineer-consultant of the Pennsylvania Railroad Co., Philadelphia.

HAROLD BYRON SMITH has been elected president of Shakeproof Lock Washer Co., Chicago, succeeding the late HAROLD C. SMITH, his father. FRANK W. ENGLAND and CARL G. OLSON have been elected vice-presidents, and CALMER L. JOHNSON is secretary-treasurer.

WILLIAM D. WIGGINS has been appointed chief engineer of the Pennsylvania Railroad system with headquarters in Philadelphia.



Eyes of Industry—For his achievements in optical science, Dr. Edward Bausch was awarded the American Society of Mechanical Engineers Medal last night at a banquet of the Society in New York. The medal was established in 1920 to mark "inventions and improvements of great merit in the technical and public sense."

GERMAN MACHINE TOOL EXECUTIVES ON U. S. VISIT

A group of about 50 German machine tool builders and distributors arrived Nov. 20 on the SS "Bremen" for a tour of American machine tool plants and metal-working factories.

REFRIGERATING MACHINERY MAKERS ELECT OFFICERS

At the Annual Meeting of the Refrigerating Machinery Association, Washington, Nov. 12 and 13, J. M. FERNALD, general manager, Baker Ice Machine Co., Inc., Omaha, was elected president. A. H. Baer, vice-president, Carbondale Machine Corp., Harrison, N. J., was elected vice-president.

Form Non-Ferrous Group

Wire Association Group to Develop Research, Production Program

Members of the Wire Association interested in non-ferrous metals, are forming a division in the Association under the chairmanship of E. W. Clark, mechanical engineer, wire and cable section, General Electric Co., Schenectady, N. Y.

The group will concentrate on research, processes and manufacture of non-ferrous wire, including insulation studies.

OBITUARIES

ROY E. CARTZDAFNER, chief engineer and works manager of Magor Car Corp., Passaic, N. J., died Nov. 12.

A. DOWNING CLARKE, 62, senior partner of Addison Clarke & Bro., Baltimore iron, steel and machinery dealers, died Nov. 15.

CLARENCE E. DAVIS, 53, of the shipbuilding firm of M. M. Davis & Co., Solomons, Md., died Nov. 15.

CHARLES A. DIETZ, 57, a founder of Admak Corp., Irvington, N. J., metal stampings and screw machine products manufacturer, died Nov. 9.

HENRY EGGERDING, 58, designer of modern, high speed printing presses and machinery, died Nov. 18 at Plainfield, N. J. He had been chief designing engineer for Walter Scott & Co., and formerly was draftsman for Pond Machine Tool Co. and Ransome Concrete Machinery Co., Plainfield.

RICHARD ELLSWORTH GEDNEY, 75, founder of Milton Point Engine Co., Rye, N. Y., and formerly a foreman in the Milton Boat Yards machine shops, died Nov. 9.

CARL LEIS, 45, chief engineer and factory manager of Johnson Bronze Co., New Castle, Pa., died Nov. 16. He was president of Mahoning-Shenango Engineers' Society.

GRANT MCCARGO, 72, president, Pittsburgh Taximeter Co. and founder of Pennsylvania Lubricating Co., died Nov. 1.

JOHN BYRD NORRIS, vice-president and co-founder of Ellicott Machine Corp., Baltimore, died Nov. 14. He and CHARLES E. ELLICOTT organized the firm in 1898.

FREDERICK PALMER, 49, vice-president in charge of production of Triangle Conduit & Cable Co., Brooklyn, N. Y., died Nov. 8. He was a native of Sweden and developed a number of machines for manufacturing conduit.

BENJAMIN HAND SCRANTON, 80, founder of the American Heater Co., and chairman of the American Electrical Heater Co., Detroit, died at Scarsdale, N. Y., Nov. 8.

BUSINESS ITEMS

Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, has opened a branch office at 804 Judd Bldg., Hartford, Conn.

Westinghouse Electric & Mfg. Co. has appointed Leland D. O'Connell manager of its Denver office. Recently he had been manager of the welding division of the company at East Pittsburgh, Pa.

Zeh & Hahnemann Co., manufacturer of presses, dies and automatic machinery, has appointed P. P. Wagener, 1714 Walnut Ave., Wilmette, Ill., its midwestern representative.

Bryant Machniery & Engineering Co., 400 West Madison Ave., Chicago, has appointed the following exclusive agents to handle Cleerman drilling machines and tool room layout machines: J. F. Owens Machinery Co., State Tower Bldg., Syracuse, and F. W. Schiefer Machinery Co., Ellwanger & Barry Bldg., Rochester, N. Y.

Wodack Electric Tool Corp., 4627 West Huron Ave., Chicago, has arranged with Climax Rock Drill & Engineering Works, Ltd., 4 Broad Street Place, London, England, for manufacturing and distributing its line of tools in Great Britain and the dominions.

Chambon Corp., printing press and machinery manufacturer formerly located at Union City, N. J., has moved to its new and larger plant at Outwater Lane and Spruce St., Garfield, N. J.

Graybar Electric Co. has appointed Harvey N. Wood sales manager of its Philadelphia office.

Symington-Gould Corp. is the new name of the Symington Co., Rochester, N. Y. The company recently purchased Gould Coupler Co. No changes in management are contemplated.

Ohio Electric Mfg. Co., 5900 Maurice Ave., Cleveland, has appointed H. W. Schmid, 1955 Ruckle St., Indianapolis, its representative in the Indianapolis territory.

Warner & Swasey Co., Cleveland, has appointed D. M. Pattison, for the past six years connected with its Chicago office, manager of the Cleveland sales territory.

MEETINGS

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, Annual Meeting, Nov. 30-Dec. 4, Engineering Societies Bldg., New York. C. E. Davis, secretary, 29 West 39th St., New York.

SOCIETY OF AUTOMOTIVE ENGINEERS, INC. Annual Meeting, Jan. 11-15, Book-Cadillac Hotel, Detroit, Mich.

TWELFTH NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING, Nov. 30-Dec. 5, Grand Central Palace, New York, Charles F. Roth, manager.

EXPORT OPPORTUNITIES

Tools, hand, and tool steel. (Agency.) Habana, Cuba. *1804.

Tools, small. (Agency.) Rio de Janeiro, Brazil. *1783.

Lathes, engine, belt driven. (Agency.) Calcutta, India. *1807.

Testing equipment, mechanical, for laboratory. (Purchase.) Lisbon, Portugal. *1816.

Wrapping machines for cellophane, and allied equipment. (Agency and Purchase.) Montreal, Canada. *1885.

Paper manufacturing machinery, all types. (Agency.) Mayaguez, Puerto Rico. *1883.

Tire retreading machinery and repair equipment. (Purchase.) Habana, Cuba. *1887.

Material handling equipment; 5-ton cranes. (Purchase.) Drinagh, Irish Free State. *1914.

Thermostats, expansion valves and refrigeration compressors. (Purchase and Agency.) London, England. *1892.

Tools, mechanics'. (Purchase.) Singapore, Straits Settlements. *1901.

Welding equipment and materials. (Purchase and Agency.) Rio de Janeiro, Brazil. *1937.

Carbon-dioxide manufacturing machinery. (Purchase.) Singapore, Straits Settlements. *1905.

Elevator driving mechanisms, passenger and freight. (Purchase.) Prague, Czechoslovakia. *1909.

Knitting machinery, all kinds. (Purchase.) Oslo, Norway, *1916.

Paper Mill Machinery. (Purchase and Agency.) London, England. *1912.

Saw mill and woodworking machinery. (Purchase.) Caracas, Venezuela. *1918.

Screw-cutting machinery. (Purchase). Prague, Czechoslovakia. *1904.

Screw-manufacturing machines, automatic. (Purchase.) Decin, Czechoslovakia. *198.

Calcium-carbide, acetate and acetic acid manufacturing machinery and equipment. (Purchase.) Bombay, India. *1915.

Slate quarry saws, excavators and conveyors. (Purchase.) Drinagh, Irish Free State. *1914.

Turpentine manufacturing machines. (Agency.) San Pedro Sula, Honduras. *1945.

* Interested American firms and individuals may obtain the names and addresses of the foreign firms making these inquiries upon application to the Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce, Washington, or any district or cooperative office. Please refer to key number.

American Machinist — REFERENCE BOOK SHEET ©

Circular and Dovetail Forming Tool Blanks

This proposed standard is sponsored by the Society of Automotive Engineers, National Machine Tool Builders Association and the American Society of Mechanical Engineers.

This standard covers sizes and types of circular and dovetail forming tool blanks for automatic screw machines. It provides interchangeability and reduces the number of blanks.

In order to establish a minimum number of blank sizes, the machines have been classified, for reference purposes, into six different groups of comparable stock capacities. Each group of machines takes a definite size of tool. The group numbers have been assigned to identify the size of tool with the machines in which it is used.

The illustrations and dimensions of the different designs have been separated from the machine classification in order that in the future new models of machines may be introduced into the respective groups without affecting the standardization of tool blanks.

To facilitate procurement of tool blanks from commercial sources, circular tools have been designated by outside diameter and width of tool blank, and dovetail tools by group number and width of tool blank.

A circular-tool blank is a disk with a centrally located mounting hole, plain or threaded, and a number of adjusting holes in the side. Circular blanks are machined on the periphery to the form of the product. A notch ground in the periphery provides a cutting edge.

A dovetail tool blank is a square or rectangular block having an external dovetail machined on one side throughout its whole length for clamping in the tool holder. The dovetail is slotted to provide adjustment. Dovetail blanks are machined to the desired profile in the side opposite the dovetail and throughout its entire length. The top of the formed section is the cutting edge.

Table 1 Machine Classification

Group Number	Type of Machine	Model	Maximum Capacity
1	No. 00 Brown & Sharpe	Standard	3/8
	No. 00 Brown & Sharpe	Universal	3/8
	No. 00 Brown & Sharpe	High Speed	3/8
	No. 00 Brown & Sharpe	Threader	3/8
	No. 19 Brown & Sharpe	.....	3/8
	Index "0"	.....	7/16
	3/8 Cleveland	Models A & B	5/8
2	3/8 Gridley	Model R6	3/8
	1/2 Davenport	Model B	7/8
	9/16 Acme Gridley	Model C	9/16
	9/16 Gridley	Model R6	9/16
	No. 0 Brown & Sharpe	Standard	5/8
	No. 0 Brown & Sharpe	High Speed	5/8
	5/8 Cleveland	Models A & B	3/4
	5/8 × 7/8 Cleveland	Model B	1 1/16
	No. 204 New Britain	.....	5/8
	7/8 Greenlee	.....	1
	7/8 × 1 1/4 Cleveland	Models A & C	7/8
3	7/8 Gridley	Model R4	7/8
	7/8 Gridley	Model G	7/8
	1 Gridley	Model R4	1
	1 Gridley	Model R6	1
	1 Acme Gridley	Model C	1
	No. 172 New Britain	.....	1
	No. 2 Brown & Sharpe	Standard	1 1/8
	No. 2 Brown & Sharpe	High Speed	1 1/8
	1 1/4 Gridley	Model R6	1 1/4
	1 1/4 Cleveland	Model A	1 3/8
	1 1/4 × 1 1/2 Cleveland	Model A	1 3/4
	1 1/4 Cleveland	Models B & C	1 3/8
	1 1/4 Cleveland	Model B	1 1/4
	1 1/4 × 1 1/2 Cleveland	Model C	1 1/2
	1 1/4 Greenlee	.....	1 1/4
	1 3/8 Gridley	Models G & Ga.	1 3/8
	1 3/8 Gridley	Model R4	1 3/8
	1 1/2 Greenlee	.....	1 1/2
	1 5/8 Gridley	Model GA	1 5/8
	1 5/8 Gridley	Model R4	1 5/8
	1 5/8 Gridley	Model R6	1 5/8
	1 5/8 Acme Gridley	Model C	1 5/8
	No. 206 New Britain	.....	1 5/8
	No. 415 New Britain	.....	1 5/8
	No. 410 New Britain	.....	...
	1 3/4 Gridley	Model G	1 3/4
	1 3/4 Greenlee	.....	1 3/4
	No. 4 Brown & Sharpe	.....	1 7/8
	2 Greenlee	.....	2
4	2 Gridley	Model RL4	2
	2 Gridley	Model R4	2
	2 Gridley	Model R6	2
	2 Cleveland	Models A, B, & C	2 1/2
	2 × 2 3/4 Cleveland	Model A	3 1/4
	2 1/4 Cleveland	Model A	2 1/2
	2 1/4 × 2 3/4 Cleveland	Model A	3 1/4
	2 1/4 Gridley	Models J, K, & L	2 1/4
	2 1/4 Gridley	Model RL4	2 1/4
	2 1/4 Gridley	Model R4	2 1/4
	2 1/4 Gridley	Model R6	2 1/4
	2 1/4 Greenlee	.....	2 1/4
5	No. 6 Brown & Sharpe	.....	2 3/8
	No. 208 New Britain	.....	2 1/2
	No. 425 New Britain	.....	2 1/2
	2 5/8 Gridley	Models G & GA	2 5/8
	2 5/8 Gridley	Model R4	2 5/8
	2 5/8 Gridley	Model R6	2 5/8
	2 3/4 × 3 3/4 Cleveland	Model A	3 1/4
	2 3/4 × 4 Cleveland	Model A	2 3/4
	3 Gridley	Model R4	3
	3 Gridley	Model R6	3
	3 5/16 Gridley	Models G & Ga	3 5/16
	3 5/16 Gridley	Model R4	3 5/16
6	3 1/4 Gridley	Models J, K, & L	3 1/4
	3 1/2 Gridley	Model R4	3 1/2
	4 Gridley	Model R4	4
	4 Cleveland	Model H	4
	4 1/4 Cleveland	Model A	4 1/2
	4 1/4 Cleveland	Model H	4 1/4
	4 1/4 Gridley	Models J, K & L	4 1/4
	4 1/2 Gridley	Model R4	4 1/2
	5 Gridley	Models J, K, & L	5
	5 Gridley	Model R4	5
	5 1/2 Cleveland	Models A & H	5 1/2
	6 3/4 Cleveland	Model A	6 3/4
	7 3/4 Cleveland	Model A	7 3/4

All dimensions are given in inches.

Circular and Dovetail Forming Tool Blanks

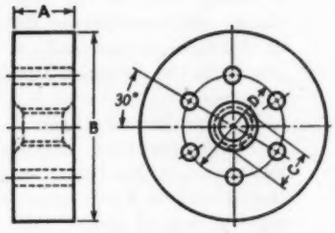


Table 2 Dimensions of Circular Tools With Threaded Holes for Groups 1, 2, and 3

Group Number	Designation[1,2] of Blanks B × A	Width of Blank A	Diam of Blank B	Threaded Mounting[3] Hole C	Adjusting Holes[4] Diam Pin Circle D	Adjusting Holes[4] Diam
1	1 3/8 × 1/2 1 3/8 × 5/8 1 3/8 × 1/2 1 3/8 × 3/4 1 3/8 × 1	1/2 5/8 1/2 3/4 1	1 3/4	3/8-16	No pin holes	
2	2 1/2 × 3/8 2 1/2 × 1/2 2 1/2 × 3/4 2 1/2 × 1 2 1/2 × 1 1/4	3/8 1/2 3/4 1 1 1/4	2 1/4	1/2-13	1 3/8	3/16
3	3 × 1/2 3 × 3/4 3 × 1 3 × 1 1/4 3 × 1 1/2	1/2 3/4 1 1 1/4 1 1/2	3	5/8-12	1 1/2	3/16

All dimensions are given in inches.

Tolerance for dimensions not otherwise specified shall be held to ±0.010.
[1] Circular tool blanks are designated by outside diameter and width of tool blank.
[2] Blanks made of high speed steel shall be stamped H.S.
[3] The threads of the hole "C" shall be made to Class 2 Fit (NC2, ASA B1.1–1935). Both ends of the threaded hole "C" shall be chamfered.
[4] The tolerance on the diameter of the six adjusting holes is plus 0.002 and minus 0.000. The tolerance on the diameter of the pin circle "D" is plus and minus 0.002.

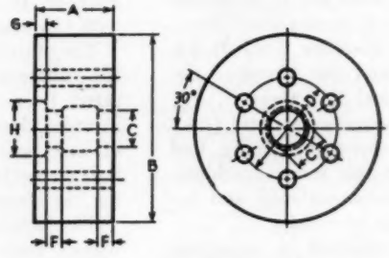


Table 3 Dimensions of Circular Tools With Counterbored Holes for Groups 4, 5, and 6

Group Number	Designation[1,2] of Blanks B × A	Width of Blank A	Diam of Blank B	Diam of Hole C	Adjusting Holes Diam Pin Circle D	Adjusting Holes Diam	Bearing Surface F	Counterbore Depth G	Counterbore Diam[3] H
4	3 1/2 × 1/2 3 1/2 × 3/4 3 1/2 × 1 3 1/2 × 1 1/2 3 1/2 × 2 3 1/2 × 2 1/2	1/2 3/4 1 1 1/2 2 2 1/2	3 1/2	3/4	1 7/8	1/4	... ... 5/16 5/16 5/16	3/16 3/16 7/16 1/2 5/8 1 1/4	1 1/32
5	4 × 5/8 4 × 1 4 × 1 1/2 4 × 2 4 × 2 1/2 4 × 3	5/8 1 1 1/2 2 2 1/2 3	4	1	2 1/8	5/16	... ... 7/16 7/16 7/16	1/2 7/16 5/8 7/16 5/8 1 1/4	1 11/32
6	5 × 5/8 5 × 1 5 × 1 1/2 5 × 2 5 × 3 5 × 4	5/8 1 1 1/2 2 3 4	5	1	2 1/8	5/16	... ... 7/16 7/16 7/16	1/2 7/16 5/8 1/2 1 1/2 2 1/4	1 11/32

All dimensions are given in inches.

Tolerance for dimensions not otherwise specified shall be held to ±0.010.
[1] Circular tool blanks are designated by outside diameter and width of tool blank.
[2] Blanks made of high speed steel shall be stamped with H.S.
[3] A slight radius shall be provided at the bottom of the counterbored hole H.
[4] The tolerance on the diameter of the six adjusting holes is plus 0.002 and minus 0.000. The tolerance on the diameter of the pin circle "D" is plus and minus 0.002.

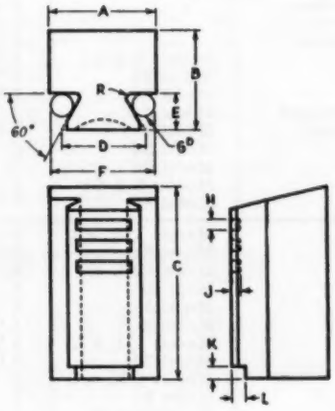


Table 4 Dimensions of Dovetail Tools

Group Number	Designation[1,2] of Blanks No. × A	Width A	Thickness B	Length C	Dovetail Width[3] D	Dovetail Thickness E	Dovetail Rad R	Across Plugs F	Plug Diam G	Adj Slots Width H	Adj Slots Depth J	Optional[4] Adj Slot Width K	Optional[4] Adj Slot Depth L
1	1 × 1 1 × 1 1/4	1 1 1/4	1	1 1/8	3/8	1/4	1/32	0.849	3/16	1/8	1/8	1/8	1/8
2	2 × 1 1/2 2 × 1 1/2 2 × 1 3/4	1 1/2 1 1/2 1 3/4	1 3/8	1 1/2	1/2	3/8	1/32	1.125	1/4	1/8	1/8	3/16	3/16
3	3 × 1 3/4 3 × 2 3 × 2 1/2 3 × 2 3/4	1 3/4 2 2 1/2 2 3/4	1 7/8	2	1 1/4	1/2	1/32	1.526	5/16	5/32	1/8	1/4	1/4
4	4 × 2 3/4 4 × 3 4 × 3 1/2 4 × 4	2 3/4 3 3 1/2 4	2 1/2	2 1/2	1 3/4	5/8	1/16	2.053	3/8	3/16	5/32	1/8	1/4
5	5 × 2 3/4 5 × 3 5 × 3 1/2 3 × 4	2 3/4 3 3 1/2 4	3	3	1 3/4	5/8	1/16	2.053	3/8	3/16	5/32	5/16	5/16
6	6 × 3 6 × 3 1/2 6 × 4 6 × 4 1/2	3 3 1/2 4 4 1/2	3 1/2	4	2	3/4	1/16	2.500	1/2	1/4	3/16	5/16	5/16

All dimensions are given in inches.

Tolerances for dimensions not otherwise specified shall be held to ±0.010.
[1] Dovetail tools are designated by group number and width of tool blank.
[2] Blanks made of high speed steel shall be stamped H.S.
[3] Width of Dovetail (D) measured to sharp corners.
[4] This slot is for a hook bolt, an optional method of adjusting dovetail tools.

Ideas FROM PRACTICAL MEN

Drill Jig for an Engine Frame

CHARLES C. TOMNEY

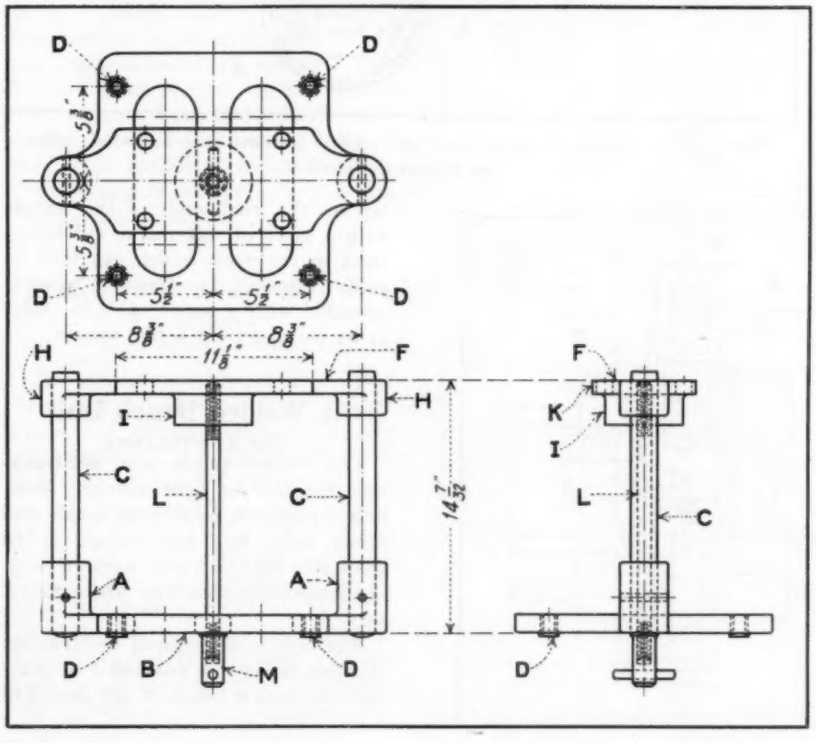
Chief Tool Designer, Carrier Corporation

A jig for drilling four $\frac{11}{16}$-in. bolt holes in the bottom of a vertical engine frame is shown. The lugs *A* on each side of the bushing plate *B* are bored to receive the guide pins *C*, which are held in place by pins. At *D* are the bushings for guiding the drill.

In using the jig, the engine frame is turned upside down, its cylinder seat resting on the base of a radial drill. The bushing plate is placed on the bottom of the frame with the guide pins hanging downward. The locating plate *F* is then inserted through the opening in the frame and is raised up so that the holes in the lugs *H* engage the guide pins in the bushing plate.

The $4\frac{3}{8}$-in. diameter boss *I* on the locating plate locates the assembled jig between the bearing bosses in one direction and the sides of the steel plate *K* locate it between the crosshead guides in the other direction. The bushing plate and the locating plate are held together by the long stud *L* and the nut *M* with cross pin.

Four bolt holes are drilled in the bottom of an engine frame by the use of this jig, which is located from the bearing bosses and the crosshead guides



Asbestos False Jaws for the Bench Vise

ELTON STERRETT

The bench vise, though presenting the work to the soldering iron advantageously, slows down the time of making the bond, because of the rapidity with which the jaws conduct heat away from the work.

To insulate the work, I made false jaws from $\frac{1}{8}$-in. sheet asbestos packing. The packing is cut into two pieces, each about 6 in. long and as wide as the vise jaws. The pieces are scored and then bent at right angles. Besides serving as an insulator, the asbestos makes a soft pad for the work and prevents it from being marred.

Homemade Electric Etching Pencil

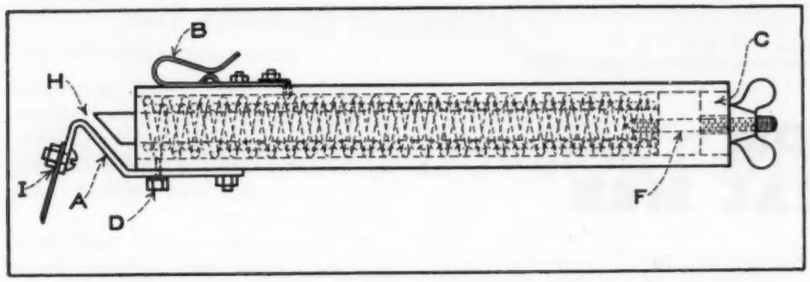
E. C. JONES

Shop Practice Department, Kansas State College

An electric etching pencil can be made from the iron core and the primary coil of a discarded Ford Model T spark coil; a thin fiber tube; a vibrating armature made from an old hacksaw blade; and a clip from an old dry battery. The core and the coil are snugly housed in the fiber tube, to which is attached the vibrating armature *A* and the battery clip *B*. The terminals of the coil are brought through suitable holes in the tube, one being attached to the plug *C* and the other to the armature at *D*. A short piece of threaded rod *F*, on which is a thumbnut, is attached to the core to provide means for adjusting it to widen or narrow the spark gap *H*, which is usually 1/16 in. when the device is working properly.

The end of the core next to the armature is beveled to present as large as possible an area to the armature. A piece of No. 14 bare copper wire about 1 in. long is attached to the armature at *I*. This wire is the electrode that arcs across the spark gap when the device is in use. The source of current is a 6-volt storage battery, although direct current of from 6 to 10 volts from any source may be used.

In use, the piece of work to have a name, number or symbol etched on it is laid on a flat plate of iron or brass connected to the negative pole of the battery. A flexible wire from the positive pole is connected to the clip *B*. The device is held in the fingers like a pencil and the electrode is brought lightly into contact with the surface to be etched. If heavy mark-



Names, numbers or symbols are readily marked with this etching pencil, which is cheaply made from a few common parts

ing is desired, the operation may be repeated, going over the previous marks several times.

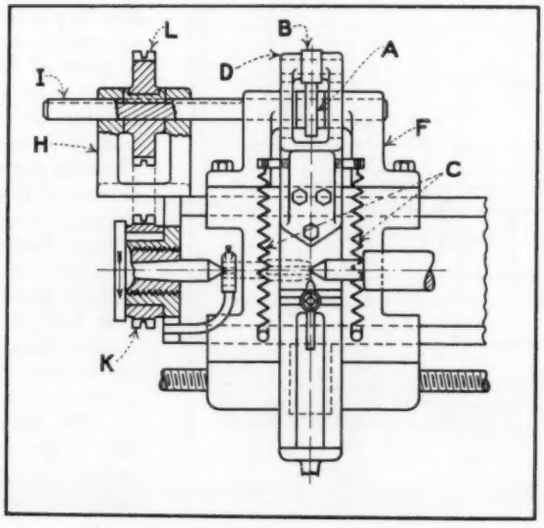
Backing-Off Attachment for the Lathe

J. R. WHITTLES

A lathe attachment for backing off or relieving the threads of taps is shown. It consists essentially of the cam *A;* cam roller *B;* springs *C;* brackets *D, F* and *H;* drive shaft *I;* and sprockets *K* and *L.*

Bracket *F* is attached to the rear of the carriage and carries bracket *D,* which slides therein and is attached to the toolblock. Bracket *D* also carries the cam roller, while the cam and the end of the drive shaft to which it is keyed are carried in bracket *F.* The drive is by chain over the sprockets *K* and *L.* Sprocket *K* is mounted on the hub of the faceplate, while sprocket *L* is mounted on the drive shaft, to which it is keyed by a feather key, so that the shaft can slide in its hub as the carriage is traversed. Bracket *H* is attached to the lathe bed and carries one end of the drive shaft and the sprocket *L.* The cam has the same number of lobes as there are in the tap to be backed off.

In operation, the cross-feed screw is disconnected from the toolblock, so that the toolblock can slide back and forth freely, the depth of cut being controlled by the compound rest. The toolblock is moved forward to the cut by the action of the cam and is returned by the springs.



The cross-feed screw is disconnected from the toolblock, which is moved forward to the cut by a cam and is returned by springs

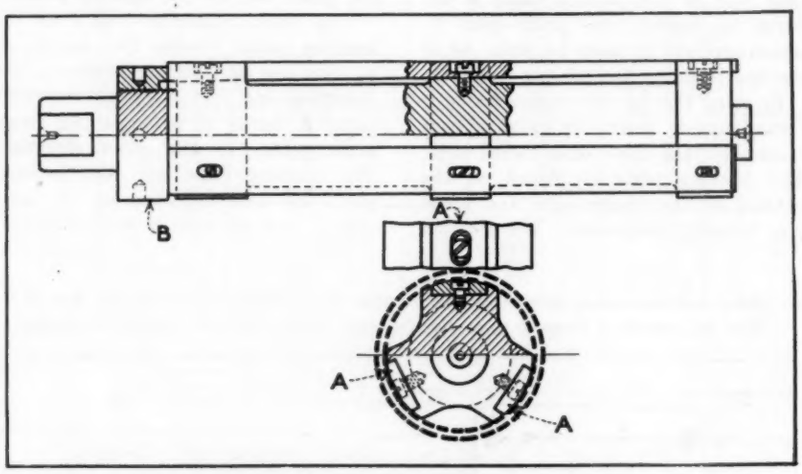
Expansion Mandrel for Long Bushings

H. L. WHEELER

Large bronze bushings that are to be turned or ground on the outer diameter are held on the expansion mandrel shown.

Three wedges *A,* equally spaced and sliding in taper seats, extend ¼ in. beyond the body at each end. These wedges are retained in place by fillister-head screws threaded into the body and engaging elongated holes in the wedges. The body of the mandrel is made of machine steel and the wedges are made of tool steel, hardened, and ground in place after assembly.

The threaded collar *B* provides means for pushing the wedges forward in their taper seats to tighten the work on the mandrel. When the threaded collar is backed off, a light tap on the small ends of the wedges with a piece of soft metal will loosen them in the work, which can then be easily removed. The threaded collar is provided with a series of ¼-in. holes in its periphery for a pin wrench.



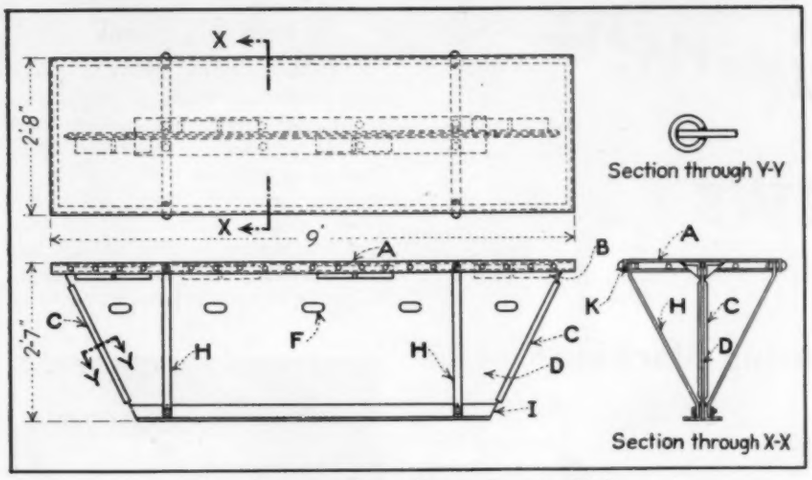
Three wedges sliding in taper seats are pushed forward by a threaded collar to tighten the work

A Welded Bench Unit

IRA S. WILLIAMS

The welded bench unit illustrated was designed for light assembly work in a department employing female and junior help, but has proved to be adaptable for the heavy work by adding supporting members where necessary.

The unit is of fireproof construction and can readily be assembled to other units to form a bench of any length or



Bench units such as this can be assembled to form a bench of any width or length

width. The construction adds to the comfort of the workers, and absence of the conventional legs makes for better housekeeping, as floor sweeping is greatly simplified. Units can be more readily moved and can be stored in a smaller space than can ordinary benches.

The top *A* is steel and has holes in the turned-down edges at convenient intervals to accommodate bolts for connecting other units or for fastening supports. Parts *B* are 3x3x3⅛-in. angles, 16 in. long, to which a stiffening web has been added. Parts *C* are ¾-in. pipes, slotted and welded to the inclined ends of the central plate and serve as guards. The central plate *D* has a series of elongated holes *F* to take care of standard electrical outlets and make possible the use of electric soldering irons and electric tools on both sides of the bench. Parts *H* are ⅛x1-in. supporting members. Parts I are 3x4x⅛-in. angles. Parts *K* are 1½x⅞x¾-in. spacers.

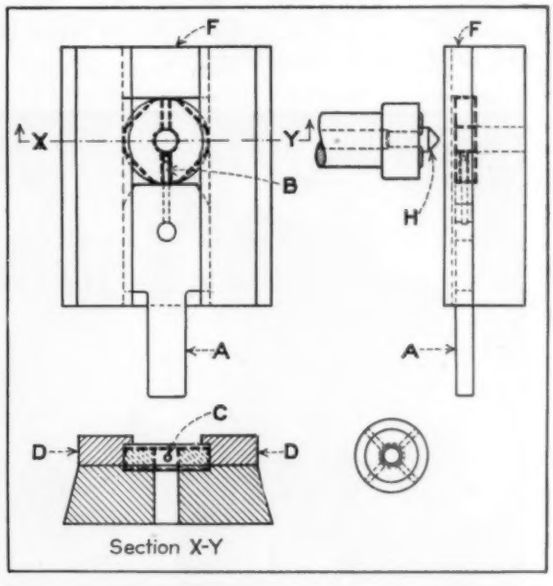
Stud Driver and Extractor

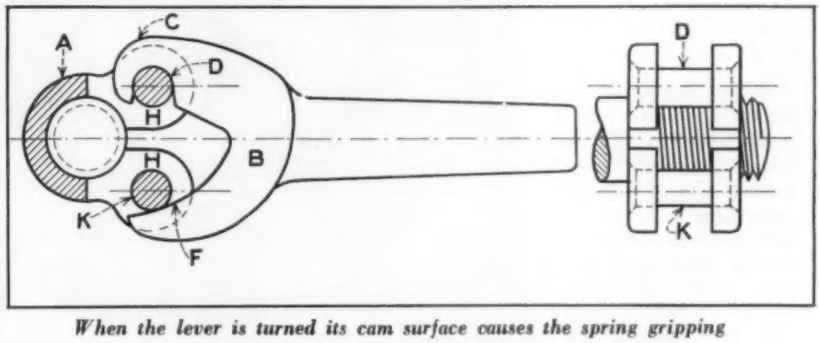
J. T. TOWLSON
Enfield, Middlesex, England

The advantages claimed for the stud driver and extractor illustrated are that the spring gripping member *A* will grip the threads of studs that are a few thousandths above or below standard size, and that there is no need to seat the gripping member on top of the stud to be driven, since the grip on the threads is sufficient for driving or extracting studs.

For driving the stud, the lever *B* is removed and the gripping member is screwed on the stud as far as is necessary. The lever is then replaced, the hooked part *C* taking hold of the fulcrum pin *D*. When the lever is pulled in a clockwise direction, its cam surface *F* draws the lugs *H* closer together and causes the gripping member to contract and grip the threads of the stud tightly. The greater the pull on the lever, the tighter the grip on the stud.

For extracting the stud, the lever is reversed in position, the pin *K* serving as the fulcrum and the cam surface *F* acting on pin *D*. Pushing the lever counter-clockwise unscrews the stud. In driving or extracting studs in close quarters, the gripping member may be turned back on the stud and a fresh grip taken, the device thus acting as a ratchet wrench.





When the lever is turned its cam surface causes the spring gripping member to contract and grip the threads on the stud tightly

Holder to Put Work in Press Tools

F. SERVER

The press tools illustrated are for swaging four shallow grooves in the brass blank indicated by heavy dotted lines.

In putting the work in place, a holder of the type shown at *A* is used. The horizontal pin *B* in the holder engages the hole *C* in the side of the work, so that the work will be held in correct orientation. In pushing the work into the die-block, both it and the holder are entered between the guides *D*, and the work is located by the stop block *F*. If for any reason the work should be slightly out of alignment with the punch, the chamfered pilot *H* in the punch will draw it into correct alignment. Pin *B* in the holder fits hole *C* closely enough for the finished work to be withdrawn by the holder.

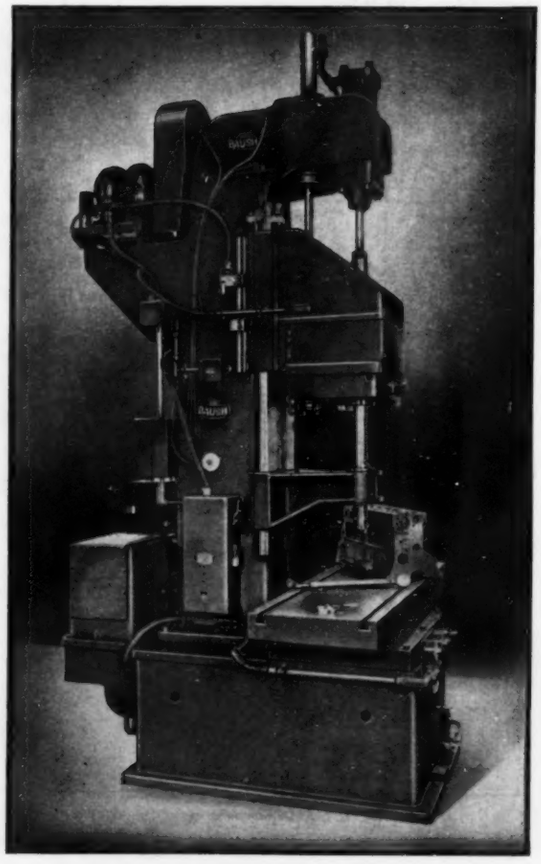
Work is entered between guides and kept in correct position by a pin in the holder engaging a hole in the side

Shop Equipment NEWS

Baush Vertical Boring Machine

This precision deep-hole cylinder boring machine is offered by the Baush Machine Tool Co., Springfield, Mass. It is designed for boring cylinders with close tolerances for straightness, alignment and true roundness. The machine consists of a heavy steel base and a rigid cast-iron column, on which is mounted the boring head and the hydraulic "centerfeed" cylinder. Built as a single-spindle or multiple-spindle machine, it can be furnished in vertical, horizontal or angular arrangements to suit particular requirements. Accurate alignment between hydraulic-feed cylinder, boring head and guide bushing is maintained by adjustable taper gibs at front and side of T-ways on the column.

The high degree of accuracy of the boring operation is attained with four special "Catspaws," in the boring bar tube, which support the bar directly behind the revolving single-point tool during the entire down feed stroke. These "Catspaws" are four non-revolving, expansible and contracting supports. They automatically expand against the freshly cut wall of the bore, while the tool is still close to the guide bushing. These four guides, sliding down the bore, give the flycutter ample support, which promotes accuracy and holds vibration to a minimum. A tool bit, having a wider face than hitherto used on long bores, can be used with a high feed and moderate cutting speed without sacrificing production or quality of finish. Demonstrations have shown that boring at a feed of 9 in. per min. will give a finish suitable for honing with a 500-grit stone. Holes 2 to 9 in. diameter can be bored to any reasonable depth.



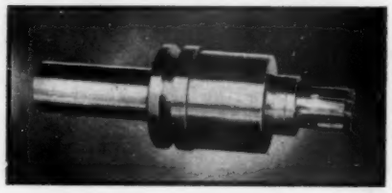
Precision boring of cylinders is done with a single-point tool, the bar being supported and guided by "catspaws" immediately behind the tool and bearing on the freshly machined bore

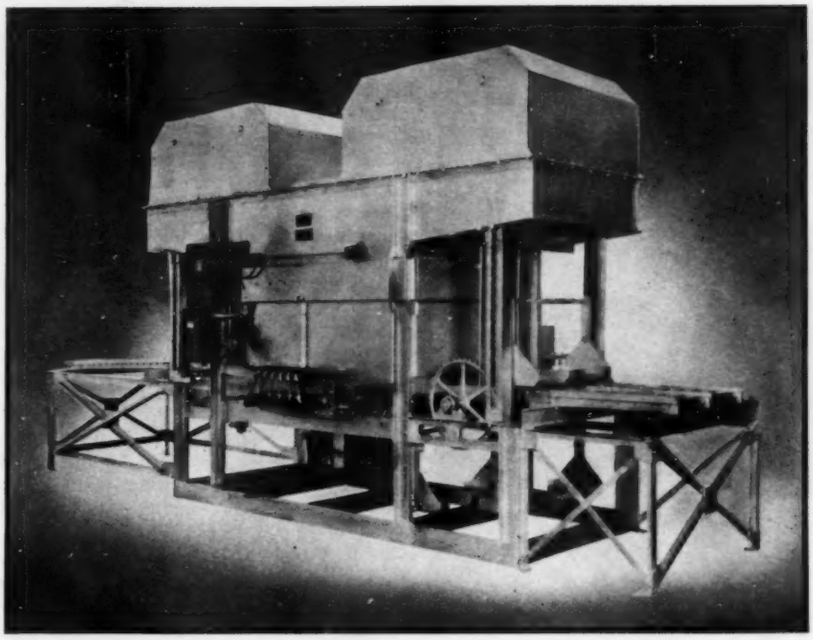
Wrigraph Adjustable Drafting Stand

L. G. Wright, Inc., 5207-11 Euclid Ave., Cleveland, Ohio, is introducing an adjustable Wrigraph drafting stand suitable for drawings under 20 x 26 in. Used in connection with a Wrigraph drafting machine, this table will serve as a complete drafting unit. The drawing board tilts 90 deg. and can be securely clamped at any angle. Height is adjustable from 33 to 45 in.

Landis Yoke-Operated Collapsible Tap

The Landis Machine Co., Waynesboro, Pa., has developed a yoke-operated collapsible tap for use on automatic screw machines. It is a modification of the Style LT collapsible tap and can be used either as a stationary or rotary tap. The detachable head feature, common to all Landis taps, whereby several sizes of heads can be applied to the same body, is used. The tap can be furnished in sizes ranging from 1⅛ to 12 in. diameter. As shown, the tap is fitted with two flanges against which a suitable forked yoke, attached to the machine, operates for expanding and collapsing the chasers.





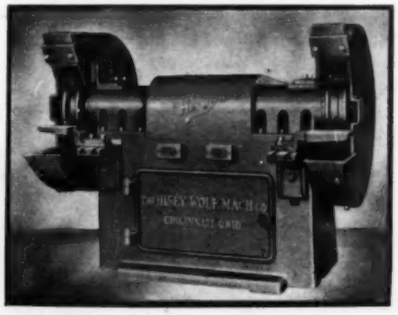
Detrex Automatic Vapor-Type Degreaser

The Detroit Rex Products Co., 13005 Hillview Ave., Detroit, Mich., has constructed an automatic, conveyorized, vapor-type Detrex Degreaser for cleaning heavy-gage metal parts. Electric immersion heaters, with thermostatically controlled relays and line switch, are employed. An automatic vapor level control device is included.

The conveyor is of the two-strand, cross-rod type and is equipped with a variable-speed drive. There are seventeen special fixtures suspended from the conveyor to handle the work baskets through the degreaser. Automatic loading and unloading is effected by roller-type gravity conveyors at each end of the machine. This machine is 20 ft. long, 6 ft. 3 in. wide and 9 ft. 8 in. high. It will clean over 6,000 lb. of heavy-gage metal parts per hour at a conveyor speed of 1 ft. per min. The complete cycle requires only about 4½ min. and the work is removed from the machine dry and free from oil.

Hisey-Wolf Heavy-Duty Snagging Grinders

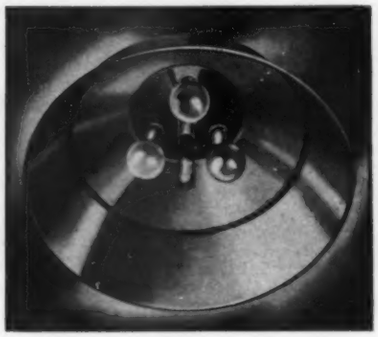
Four sizes and fifteen types make up the line of heavy-duty Texdrive snagging grinders manufactured by The Hisey-Wolf Machine Co., Cincinnati, Ohio. Single-spindle grinders, multi-speed grinders and two spindle grinders with one or more speeds are available in 5, 7½, 10 and 15 hp. sizes. Designed for severe duty, weight is distributed to minimize vibration. Wheel guards and mounting brackets are of steel and have hinged covers and steel chip breakers. Guards are adjustable to size of wheel. Work supports have horizontal and vertical adjustment. All multi-speed machines have a safety device so that wheels will operate at proper speed.



Westinghouse Mercury Lighting Unit

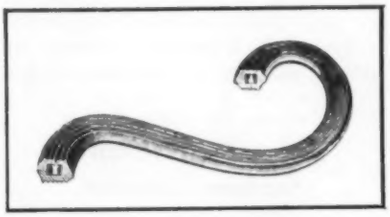
A combination, 250-watt, mercury-mazda lighting unit, for industrial lighting where color correction is necessary, has been announced by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Designed for mounting heights of 8 to 18 ft., this unit mixes the light qualities of the mazda with those of the mercury lamp, giving the required color correction.

Two circuits are used, one to control the mercury lamp and one to control the mazda lamps. Design is such as to allow three 60-, 75- or 100-watt mazda lamps to be used without interfering with the restarting of the mercury lamp in case of voltage interruption.



Wade Lead-Core Adjustable Curve

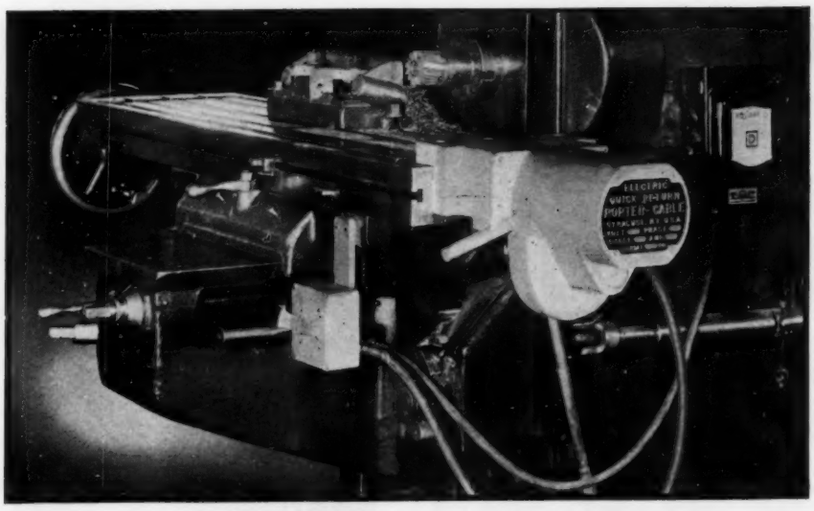
For drafting-room use, the Wade Instrument Co., 2274 Brooklyn Station, Cleveland, Ohio, is offering a rubber, adjustable curve. This instrument has a lead-core held between two spring steel strips. All parts of the core are free, eliminating stiffness and resulting in natural curves. The top and bottom of the curve are wide and



corrugated, giving room to rest the fingers and facilitating holding it in place. A low drawing edge on one side makes it possible to support the pen or pencil close to the paper without danger of inkblots. A center drawing edge on the other side is useful for opposite curves and for making two or more parallel lines at one setting.

Porter-Cable Quick Return

The "Electric Quick Return" attachment, for use on production milling machines on which no quick-return feature has been incorporated, is announced by the Porter-Cable Machine Co, Syracuse, N. Y. It is not



The Electric Quick Return reduces production time and operator fatigue on long cut jobs

applicable to rack-type milling machines. The unit is easily mounted by means of special brackets, the drive being connected to the feed screw through a safety clutch. Table can still be manually traversed by hand crank at opposite end.

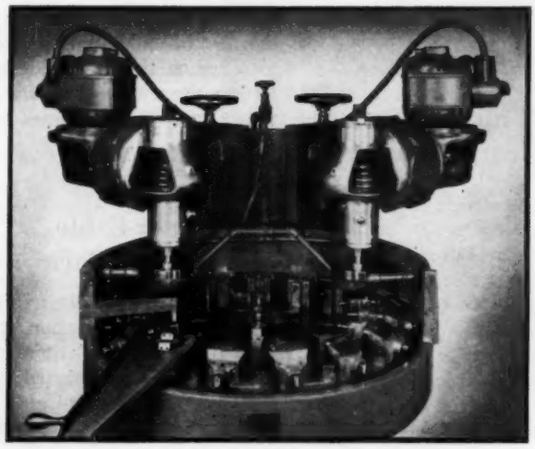
The ½-hp. motor, with special torque winding, operates at 1,800 r.p.m. It is of a special reversible type and is totally inclosed in the aluminum housing. Drive is through a 2½ to 1 gear reduction, giving a table travel of approximately 30 ft. per min. Unit is operated by conveniently located lever-type switches. A brake is provided for emergency stops.

Bergram Automatic Surface Grinder

The Type DG-1 automatic surface grinding machine, announced by the Bergram Mechanical Engineering Co., New Britain, Conn., is designed for grinding small parts in large quantities. Magnetic or automatic chucks can be furnished to accommodate parts of any shape. Two diamonds are mounted on the rotating table to keep the roughing and finishing wheels dressed to insure consistent accuracy in predetermined sizes.

Using automatic chucks, work is loaded into the chuck units which automatically close for the grinding cycle, then reopen for automatic work ejection after one revolution. It is not necessary to stop the machine during the production cycle. Grinding wheels up to 8 in. diameter and motors up to 3 hp. capacity are used in the larger size machines. Production is 1,000 pieces per hour for the parts shown.

Special chucks can be furnished with the Bergram surface grinder to take odd-shaped parts



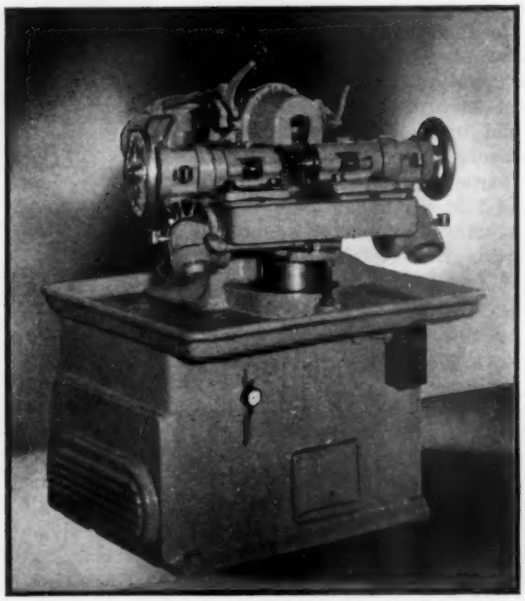
Lipe "Rutac" Gear Chamferer

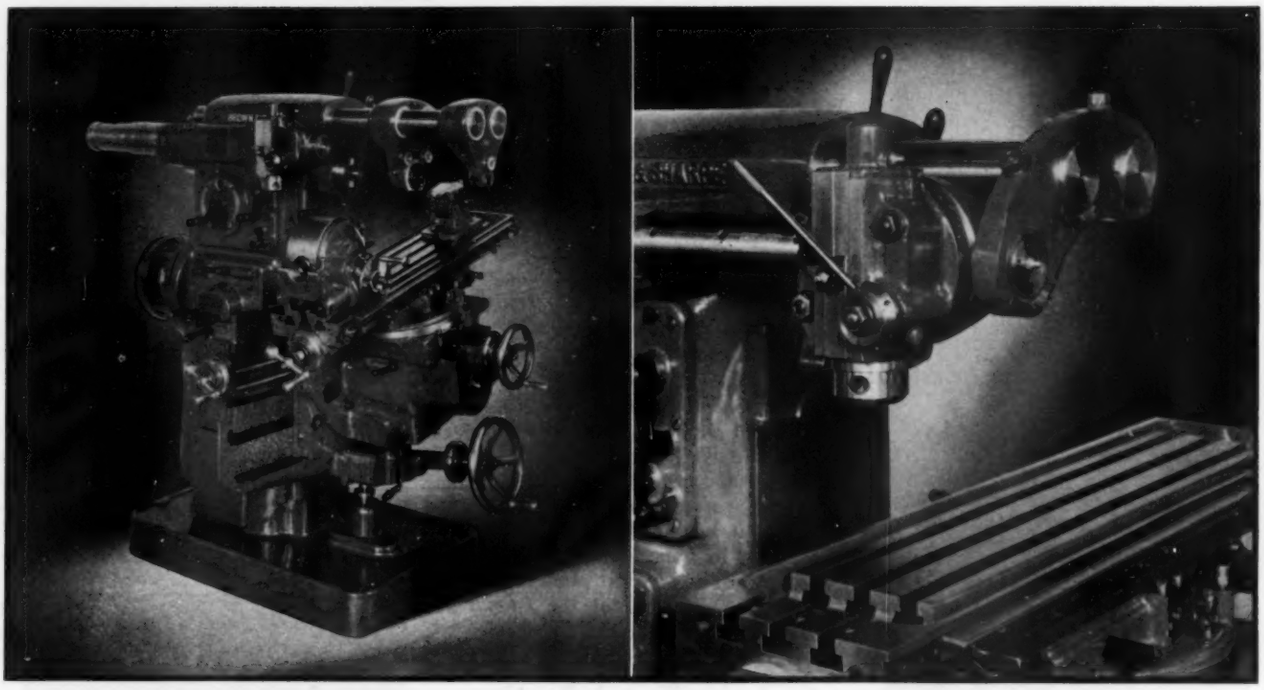
The "Rutac" rotary universal acute angle gear tooth chamfering machine is manufactured by W. C Lipe, Inc., 208 S. Geddes St., Syracuse, N. Y. It is designed for chamfering the acute angle at the ends of the teeth of helical gears and pinions, spiral bevel gears and pinions and the sharp corners of the ends of spur gear teeth. It is a high production machine, capable of chamfering teeth at the rate of 300 to 600 per min. Of universal design, it is so constructed that within the range of the capacity of the machine, any type or size of the above gears can be handled by changing timing gears and holding equipment, and resetting the machine to a charted set up.

By means of a burring tool, which is automatically retracted from the work to permit easy loading, the ends of the teeth are burred at the same time that the chamfering operation is performed.

Gears having from 12 to 48 teeth of 4 to 20 diametrical pitch and up to 2 in. face width can be handled. Maximum gear diameter is 8 in., minimum is 1 in. with bore and smaller with shank. Complete change in set up requires from 1 to 1¾ hr., depending on extent of change. Handling time for gear averages 8 sec. Drive is by means of a 1-hp., 900-r.p.m. motor. Floor space required is 40x44 in. and the machine weighs 3,660 lb.

Adjustable cutter-blade holders facilitate setting the profile cutting edge of the blade in correct relation with the gear tooth to be chamfered





Now featured on the B. & S. No. 0 Omniversal milling machine, the Omniversal milling head is rapidly and accurately adjustable to facilitate machining parts at unusual angles

B. & S. No. 0 Omniversal Milling Machine

The No. 0 Omniversal milling machine introduced by Brown & Sharpe Mfg. Co., Providence, R. I., at the 1935 Machine Tool Show (*AM*—Vol. 79, page 658), has been equipped with an Omniversal milling head that increases the range of the machine. Another added feature is provision for synchronizing the knee-slide feed and headstock-spindle rotation for milling spirals. In addition to all the fundamental movements and adjustments common to the universal-type milling machine, the Omniversal machine has an angular adjustment of the knee in a vertical plane at right angles to the spindle. It also has a horizontal feed for the entire knee assembly in this vertical plane.

The addition of the Omniversal head provides further means of obtaining accurate, simple and compound angular settings in any plane. Work may be milled in a number of planes or drilled, bored or reamed at different angles without the use of special fixtures or attachments, often without need of relocating the work in the holding device.

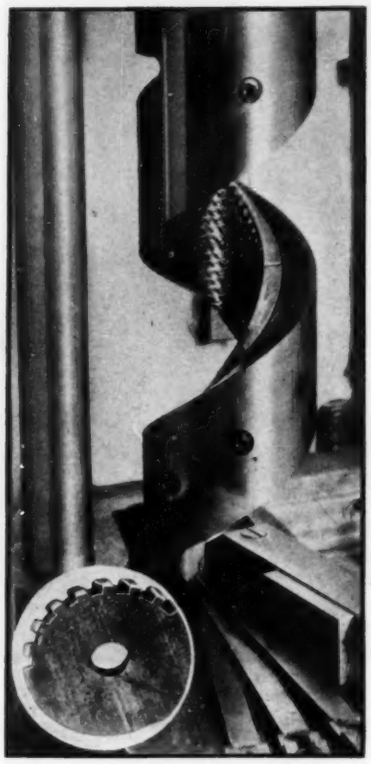
In general, the head has four types of adjustment, any one of which can be used in combination with one or more of the others. It may be used: (1) either in its normal position at the left side of the column, or in either of the overarm holes; (2) the head may be adjusted 14 in. parallel to the overarms when used in the left of column position and 5⅞ in. when used in either overarm position; (3) the head has universal angular adjustment in a horizontal or vertical plane; and (4) the spindle itself has a 2-in. axial hand-feed and may be clamped in position anywhere along this path of travel. Angular adjustments are set by verniers reading to two minutes of arc.

The milling head spindle, in all positions, is gear-driven from the rear of the machine spindle. It has a speed range of 88 to 2,860 r.p.m., in approximately a 2 to 1 ratio with the machine spindle speeds.

Despatch Drawing and Tempering Furnace

The Despatch Oven Co., 622 Ninth St., S. E., Minneapolis, Minn., has introduced a convected-air, gas-fired furnace for drawing and tempering dense loads. Design features assure accurate temperature control, rapid heat transfer and uniform results. Such parts as bolts, rivets, washers, nuts, small gears, cutters, springs, small tools and dies are economically handled in steel baskets.

Heating is accomplished with an atmospheric-type burner which has a specially constructed combustion chamber of refractory brick. This burner is easily adjusted to all kinds of gas at various pressures. Ample reserve is provided in the heating system to provide fast preheating and rapid heat transfer. The blower forces heated air through the load from the bottom of the pot and air coming from the top of the pot is directed to the heater for recirculating. These furnaces are available for two temperature ranges, 800 F. or 1,200 F. maximum. Low working height, top loading and minimum floor space requirements are featured.



Colonial Internal Helical Broach

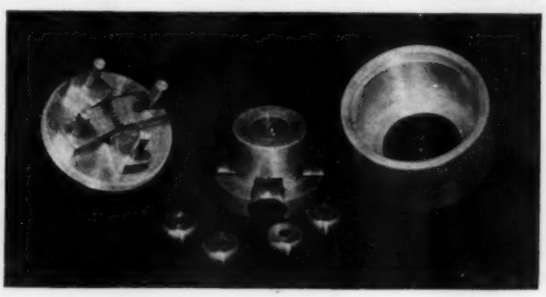
A novel internal helical broach for an external broaching operation has been developed by the Colonial Broach Co., Detroit, Mich. This broach was made for cutting the teeth on worm-wheel sectors for a casement-window mechanism. The broach is made in sections that are mounted in the helical broach holder.

Two broaches, one having a right-hand and the other a left-hand lead, are mounted in a standard Colonial hydraulic broaching press provided with a helical-feed head. Three sectors are cut at each stroke by each broach, production being at the rate of 200 pieces per hour.

Harris No. 1 Flexible Coupling

A universal, self-aligning shaft coupling, adapted to drives difficult to align, or where alignment is not assured, has been developed by the Harris Coupling Co., 265 West 40th St., New York, N. Y. The coupling allows parallel misalignment of $\frac{3}{16}$ in., angular misalignment of 15 deg. either way, and provides for an end float of $\frac{1}{2}$ in. Lateral thrust is said to be eliminated on the driving and driven shafts.

The No. 1 size coupling now being introduced is shown in the exploded view. The coupling half at the left has four oscillating members fitted with pins at one end and having a gear sector cut in the other end. These segments oscillate and permit the pins to assume the necessary radial offset position for parallel misalignment conditions. The rollers go on the pins and fit into the machined recesses in the spider shown at the center. The machined recesses are radiused so that angular misalignment can be taken care of. A dust and oil-tight cover, at right, completes the coupling. This cover serves as a container for oil to lubricate the working parts of the coupling and it has an oil seal. Couplings are made in horsepower ranges from 3 to 500 hp. and in bore sizes of $\frac{3}{4}$ in. and up. Either half of the coupling can be the driving side.



Explosion-Tested Westinghouse Motors

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., is offering an improved design of Type SK, explosion-tested, fan-cooled, totally-enclosed d.c. motors. These motors are available in sizes ranging from 5 to 75 hp. in 115-, 230- and 550-volt capacities. They are designed for use in locations where explosive gases or dust conditions exist.

Access to the commutator and brushes is obtained through four hand holes in a double-walled bracket on the commutation end of the motor. The hand-hole covers are readily removable to permit inspection and necessary adjustments. Each cover can be sealed or locked to prevent unauthorized removal.

The motors are tested to withstand an internal explosion of methane gas or coal dust without injury to the equipment and without emitting flames or sparks which would ignite surrounding gas.

Airco-Twin Welding Hose

The Air Reduction Sales Co., 60 E. 42nd St., New York, N. Y., is now offering the "Airco-Twin" hose for oxyacetylene welding and cutting operations. Two lines of cord-reinforced hose are molded side by side into a single, flexible unit. For ready identification in coupling and application, the acetylene line is colored red; the oxygen line green. This hose is available in lengths up to several hundred feet.

No special tool is required to prepare this hose for use. It is only necessary to take a sharp knife and split the hose at each end along the joint line for a sufficient distance to form a convenient separation. Two ferrules are supplied with each length of hose, one is fixed at each end of the hose by tapping it lightly.

Tek-Lace Flexible Belt Lacing

The Sudbury Laboratory, Box 330, South Sudbury, Mass., is distributing a non-metallic belt lacing suitable for flat or V-belts. "Tek-Lace" is a treated fiber lacing of high tensile strength that can be applied with an ordinary awl or other piercing tool. Each strand is 0.55-in. diameter and has a tensile strength of 100 lb. Joints made with this lacing are smooth and flexible.

Cincinnati High-Speed Universal Milling Head

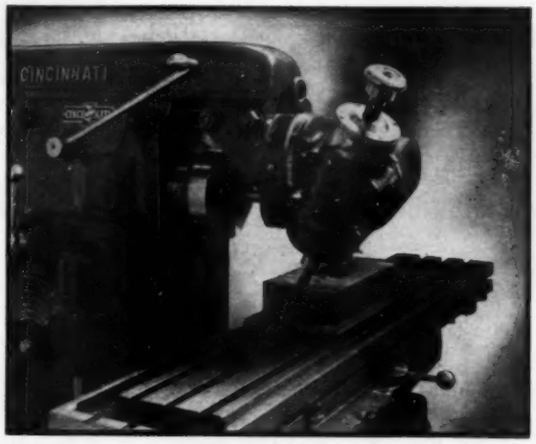
Made in sizes to fit their L-type, MH and dial-type milling machines, this high-speed universal milling head is offered by Cincinnati Milling Machine and Cincinnati Grinders, Inc., Marburg and South St., Cincinnati, Ohio, for tool room and light production work. This attachment is suitable for use with small milling cutters, drills, or boring tools.

The attachment is driven directly from the machine spindle by means of a splined shaft fitting into an adapter. This adapter is driven by the arbor driving keys and centered from the spindle. The overarm of the milling machine constitutes the supporting element of the head. This permits full use of the machine cross range. Gears and shafts are made of heat-treated alloy steel and the drive is supported on anti-friction bearings throughout.

The attachment spindle may be swiveled 360 deg. in a plane parallel to the face of the machine column. It also can be swiveled 90 deg. in a plane at right angles to the face of the column. Graduations around the circumference of the housings allow accurate setting of the cutter to any desired angle within the above limits. Four clamping bolts in each swiveling element firmly hold the spindle in the desired position.

Extra equipment available for this attachment includes a handling crane that is mounted on the machine, a quill feeding mechanism and a quick-change adapter for the spindle nose. The quill feed and the adapter are shown in the acocmpanying illustration Contrary to usual practice, the quill device may be installed at any time.

The attachment spindle has a No. 40 National Standard taper. A No. 9 B. & S. taper is used in the quill. Quill feed adjustment is 2¼ in. Distance from the face of the machine column to the center of the attachment spindle is adjustable from 11$\frac{13}{16}$ in. minimum to 18$\frac{13}{16}$ in. maximum.



Almost any angular position of the drill or cutter is possible with this high-speed attachment

work. It can also be used to fabricate metal roofs and ceilings, steel cabinets, ventilating systems and steam fittings.

Net weight is 140 lb. and over-all dimensions are 27x24x14 in. Current range is from 25 to 75 amp., controlled by a nine-point tap switch. The unit is mounted on casters.

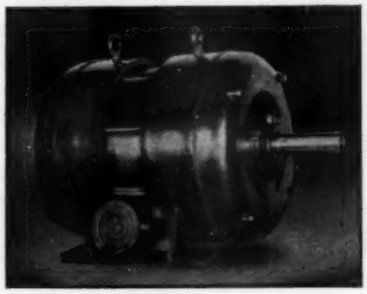
Swartz & White Flexible-Shaft Grinders

The Series 1500 and Series 4500 flexible-shaft grinders manufactured by the Swartz & White Mfg. Co., 243 Water St., Binghamton, N. Y., have been improved by adding a clamping bracket at the top of the stand. This makes possible rigid mounting of the wheelhead so that work can be brought to the wheel. The machines have also been equipped with a V-belt type drive.

These machines are available in five sizes, ranging from ¼ to 2 hp. capacity. Grinding wheel size ranges from 4x1x½ in. on the ¼ hp. machine to 10x1x½ in. on the 2 hp. unit.

Cleveland Inclosed Fan-Cooled Motors

The Cleveland Electric Motor Co., 5213 Chester Ave., Cleveland, Ohio, is now in position to furnish inclosed, fan-cooled a.c. motors in ratings from 1 to 60 hp. These motors are available in standard frames and in practically all N.E.M.A. frames. Particular care has been taken to insure ease of assembly and disassembly.

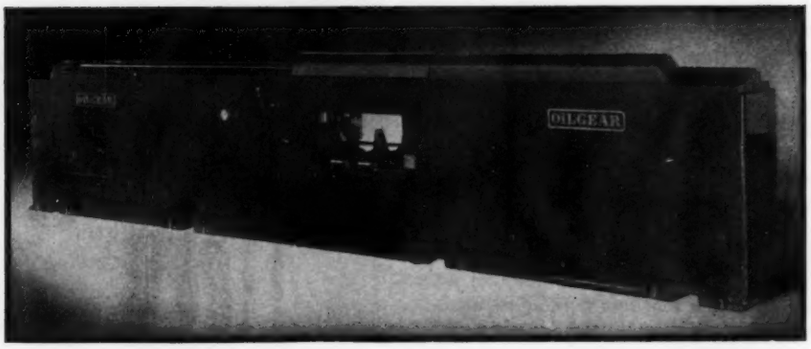


G.E. Low-Range D.C. Arc Welder

A low-range, d.c. welder utilizing rectifier bulbs instead of rotating equipment is announced by the General Electric Co., Schenectady, N. Y. Using four mercury-Tungar bulbs, the unit operates on three-phase, 50- or 60-cycle, 230-, 440- or 550-volt circuits.

This welder has ample capacity for welding all light-gage car or truck parts in construction and maintenance

Oilgear Special Horizontal Surface Broaching Machine



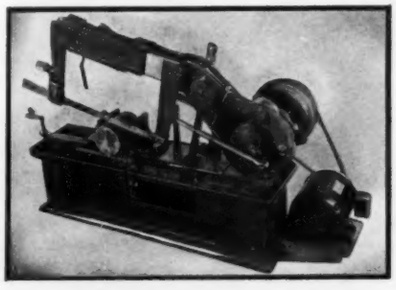
This hydraulic surface broaching machine, manufactured by the Oilgear Co., 1319 W. Bruce St., Milwaukee, Wis., is used for rough and finish broaching the sides and bottom of the main-bearing cap surfaces that meet with the web of the crank-case of an 8-cylinder motor. A similar machine broaches the main-lock seat and rough crank bore in 6- and 8-cylinder blocks.

The machine illustrated has a normal broaching speed of 24 ft. per min. and a return speed of 60 ft. per min. Frame is of heavy all-steel welded construction. The 25-hp. motor and direct-connected Type "DH-3511" two-way, variable-delivery pump are mounted inside the frame. The generative-type tools are mounted in an inverted, heavy toolslide above the work. Production capacity is 60 blocks per hour. Positive interlocks are provided for each step in the operating cycle.

Motor blocks are handled on a conveyor to and from the working position at the center of the machine. Each block is moved by the operator from the main conveyor onto a short conveyor in the machine. The operator then trips a lever and the block is automatically raised to broaching position. Another lever clamps the block in place. The main control lever is then tripped and the slide and tools on top of the machine sweep across the block, finishing the surfaces in one stroke. Before the broach slide returns, the block is lowered and removed from the machine. Chips fall away from the tools into compartments in the base of the machine. Pressure lubrication is provided for the slide and the hardened and ground steel ways. The machine is 28-in. wide, 67-in. high and 26-ft. long and weighs 32,000 lb. The second machine weighs 27,300 lb.

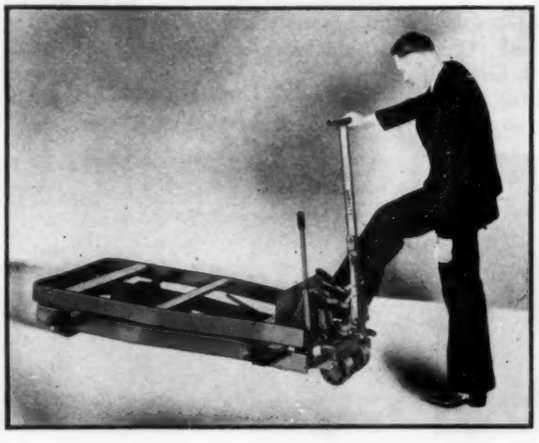
Kelley Power Hacksaw

A 10 x 10 in. power hacksaw of the gravity-feed type is announced by the Kelley Gear & Tool Co., 1406 W. State St., Bristol, Tenn. This machine has a relieving mechanism operated by a cam, rack and pinion and friction clutch. The blade is raised from the



work at the extreme end of the cutting stroke and lowered to cutting position at the completion of the return stroke.

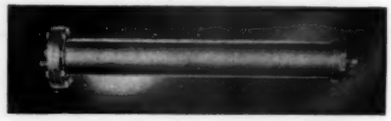
Drive is by electric motor through V-belt and 3-step cone sheaves. A planetary gear reducer, having case-hardened gears operating in an oil bath, is located inside the drive sheave on the machine. Speeds of 80, 100, and 126 strokes per min. are obtained by shifting the V-belt on the sheaves. Three other speeds can be obtained by shifting the 1-hp., 1,725 r.p.m. motor on the mounting rod. These speeds are 90, 110 and 118 strokes per min. A one-speed belt-drive model is also available.



DeVilbiss HP-504-2 Air-Line Condenser

The improved extra-heavy-duty condenser, Type HP-504-2, announced by The DeVilbiss Co, Toledo, Ohio, effectively removes oil and water which finds its way into the air line. This is accomplished by a baffle arrangement within the condenser and a pair of conveniently located filter pads. These filter pads can be removed and replaced without disconnecting the condenser from the air line.

This unit is recommended for efficient operation at a maximum air delivery volume of 75 cu.ft. per min. A drain valve on the bottom of the condenser permits drainage of accumulated condensation. The unit is 4 ft. 8 in. long, has a tube diameter of 6 in., takes a 2 in. pipe thread on inlet and outlet tubes, and has a net weight of 140 lb.



Barrett Adjustable Lift Truck Frame

An auxiliary lift truck frame is announced by Barrett-Cravens Co., 3255 West 30th Street, Chicago, for use with their line of trucks. When mounted on a truck 6 in. high in the lowered position, the unit can handle skids with a clearance of 6½ to 10½ in., and when used with a truck 7 in. high it will handle skids with underneath clearances up to 12 in. When the truck is under the skid the auxiliary handle is pulled forward and the frame is brought up snug under the load and is held by a ratchet device. A slight kick on the release bar lowers the load.

The Round Table

ONE FOREMAN

"Who's going to be foreman of the second shift, Al? Have you picked him yet?" Ed was in conference with his friend over ways and means of taking care of a sudden increase in orders.

"Sure," said Al. "Jim Taylor."

"But Jim is foreman of the day shift now. How does he feel about being shifted to night work? And who is going to replace him on the first shift?"

"Nobody, to answer your last question. O.K., to answer your first one, because he isn't going to work nights, much."

"Say, are you trying to kid me, or has this rush of business gone to your head? How can a man be foreman of both shifts, and live?"

"Easy. He can take on a couple more shifts, if he has to."

"Come on, come on, explain yourself."

"All right," said Al. "Remember what a fuss we used to have when the old shop was on two shifts? How the night shift got out most of the work, and how the day shift griped at having to spend so much time fixing up the machines?"

"I'll say I do. And we're going to have it again if I'm any judge."

"Well, here's how I'm going to avoid it. Jim is going to have an assistant foreman who will be on the night shift, but he's responsible to Jim, and Jim is responsible to me for what happens on either shift. See how easy it is to dodge the old buck passing?"

"Not as well as you do, Al. Looks to me like Jim would be up half the night."

"If he is, he can't be a real foreman. I don't want a foreman who insists on showing every man in his department just how every little job is done. He's got other things to do. If he gets the men in the habit of running to him with every question he won't have time for anything else. I expect him to make his assistant assume a lot of responsibility."

"Sure, but suppose something goes

wrong on the second shift, this assistant would call you, wouldn't he?"

"Not more than once. He's responsible to Jim, not to me. Of course, I expect Jim will stay on to see the second shift started and tell his assistant what has to be done. But there's nothing very unusual about that."

"All right, try it, but I'll bet Jim Taylor quits inside of a month."

Is it feasible to make one foreman responsible for more than one shift? Will Al's plan avoid buck passing?

DISCUSSION

Bonuses for Toolmakers

Production incentives in the form of cash bonuses for tool and diemakers are not new, but I have never heard of the scheme suggested by Al where part of the bonus depends upon the life of the die. All diemakers know that anything is likely to happen to a die after it has gone to the press room. Hidden defects in the steel may make themselves known after a few strokes of the press, or carelessness on the part of the press operator may be a contributing factor to its injury. In any event, the diemaker cannot be held responsible after a die has been passed by the inspector.

The most acceptable system I know of is where a specified time is set for making a die, jig or fixture. If the job is finished ahead of schedule, one-half of the saving goes to the maker.

I have found that most highly skilled tool and diemakers prefer to work on an hourly basis, and that most successful toolrooms are inclined to look askance on incentive plans when extreme accuracy is at stake. Most men find it difficult to concentrate on their work when they know that each tick of the clock has a marked significance in regard to the contents of their pay envelopes. Fine toolmaking demands that time be subservient to accuracy, and that

must be taken into consideration where any bonus plan is to be effective. —Robert S. Alexander

Utilizing the individual tool estimate as a basis for the incentive is hazardous. Tool estimates are difficult to control because of the many variables encountered in toolroom work. Where the design of tools does not offer manufacturing problems of an involved nature, estimates are generally satisfactory, but where tools are complicated and of costly construction the estimator invariably under-estimates the cost. In consequence, the more highly skilled worker, to whom such work is necessarily delegated, is penalized.

The incentive motive in the toolroom is fine, but the basis for the system should be the sum of all tool estimates over a given period, and the bonus should be of the group type with all workers participating in an equitable distribution of the savings. —Ira S. Williams.

Bonus payments for toolmaking present some problems, but will work out satisfactorily in most shops if handled correctly. Most toolmakers resent the fact that many machine operators, on piece work, earn more than the toolmakers. The younger men will generally work under a bonus plan, but the older men are apt to look on toolmaking as a "profession," and feel themselves above working on a bonus, or other wage incentive plan.

Considerable tact is required to start a bonus plan in the toolroom. The management must play absolutely square with the men, when setting the time on jobs. Don't use a complicated system, but a simple contract or piecepayment system, so that the workman will get just what he knows is coming to him, and get it promptly. Every job should be paid for on the next pay day, following the acceptance of a finished job. If it is a long job, regular weekly payments should be made, at the man's regular rate, with the accumulated bonus payment, soon after completion and acceptance of the job.

The man who sets the time on jobs must be a skilled estimator, and should confer with the toolroom foreman, and occasionally he may discuss a new job with a toolmaker. The inspector will probably think his work will increase, but there are only a few men who will try to pass along a bad job, and these men will soon be "spotted," and their work carefully checked.

I speak from experience, as I worked on accurate jigs and fixtures over twenty years ago, in a plant where bonus payments to toolmakers were just as common as piecework in the production departments. At the present time, we set a contract price on all new tools and on some repair jobs, in our own plant, with results which are satisfactory to both the management and the men.

I find that the men are prompt to report any lack of tools, or machines needing even minor repairs, whereas most toolmakers on a straight hourly rate may grumble among themselves, but generally continue to use poor tools or machines. They probably figure that if the management can stand such wasteful methods, the men will have to put up with them. A toolmaker, working to earn a bonus, knows such poor equipment will affect his earnings and will quickly notify the foreman of needed repairs or replacements.

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Most shops have some "prima donna" mechanics, who may object to a bonus system, and there may be a few "slackers," who are afraid they will be "shown up." Just as Ed says, a real mechanic takes pride in producing a good job, but that's no reason why he shouldn't make some extra money at the same time. The "slackers" will soon identify themselves, by their lower earnings, while the real workers should be suitably rewarded by increased pay and an opportunity for advancement. —H. M. DARLING.

Jam Threads

This is one time where Al seems to have the wrong side of the argument. While it must be admitted that there are certain places where it is wise to use so-called jam threads, it is very doubtful if their use is justified on costly machinery. The principle is very much the same as that in the application of so-called locknuts, but locknuts can be applied with the certainty that no actual damage is being done to the threads. After all, when the threads are sufficiently mismated as to cause them to flow and make a tight fit, something in strength is sacrificed. It might be said that the first step has been taken toward a stripped thread.

There are other means of avoiding the use of castellated nuts and cotter pins. Lock washers often do the job very well. They are now so made that they do not tangle, as do some of the older types, so that the loss of time in untangling them on the assembly floor is eliminated. Another thing that can be done when one wishes to be very sure that a nut will not loosen on the threads of a bolt is to smear a little iron cement in the threads. That material expands and binds the nut in place without any particular strain being imposed on the threads. —JOHN E. HYLER,
Draftsman, R. G. Le Tourneau, Inc.

Something Different

Many years ago, when in charge of my first plant, I was drawn into an argument with the sales manager about a product change. We referred the matter to the owner. I'll never forget that very successful man's words to me:

"Matter," he said, "the sales department has many customers. You've got only one customer—the sales department. It's up to you to give them what they want, in so far as you can do so. They know what they can sell."

I've learned since that his decision was best for the welfare of the business. The sales department has to sell what the public wants.

Competition forces all manufacturers continually to improve and better their product by increasing its utility or making its appearance more attractive. Good products and successful businesses are not made from brilliant major changes; they are built from steady continual improvement. Major changes and improvements, if too major, are just a "pain in the neck" to the sales department, for they mean another pioneering campaign to wean an apathetic public from something they know to something that might work. So I suggest we outvote Al this time. —JAMES K. MATTER.

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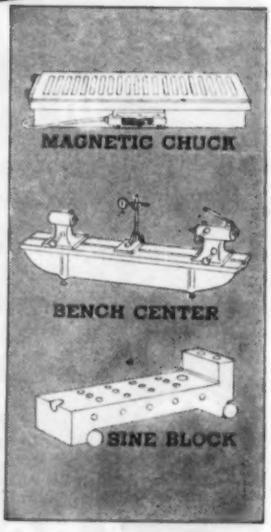

ATTENTION: TOOLROOM FOREMEN, INSPECTORS, TOOLMAKERS, JOB SHOPS. Unusual jobs are common at Taft-Peirce. And such jobs have resulted in the development of many shop accessories that have a wide range of application that offer new opportunities to save time and work, improve accuracy, increase machine utility. These devices are standardized, put in production and *stocked*—taken out of the range of "special prices."

A few of these set-up and inspection tools are shown. An adjustable angle plate for quick, accurate setting of compound angles. An adjustable toolmaker's knee for checking angular work. A sine block that combines the features of a sine bar and right angle iron. A bench center that permits work to be held, spring center withdrawn, with one hand. And the finest magnetic chuck that money can buy. Also: Sine Bars. V Blocks. Parallels. Squares. Straight Edges. Surfaces Plates. Bench Blocks. Dial Indicators. Write for prices.

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NEW BOOKS

MAINTENANCE OF HIGH-SPEED DIESEL ENGINES—*By Arthur W. Judge, associate member, Institution of Automobile Engineers, Great Britain. 192 pages, 5½x8½ in. 170 illustrations. Published by D. Van Nostrand & Co., Inc., 250 Fourth Ave., New York, N. Y. Price $5.*

A reader familiar with gas-engine maintenance will readily grasp the detail presented in this book on the maintenance of high-speed diesel engines for transportation use. As such it should be of interest to diesel-engine fleet owners, maintenance engineers, and mechanics. The data covers American, English and German engines and their important accessories.

Included are data on engine adjustments, analysis of troubles and remedies, fuel pumps and injectors, starting and slow running, much of it experience of English diesel builders.

The book is divided into twelve chapters: Working principles; practice; general maintenance, cylinders, pistons and rings, valves and seats; connecting rod and crankshaft; fuel injection system; timing the fuel pump and the governor; starting procedure and running troubles, glow plugs, filters, fuels, and Bosch fuel-injection equipment.

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MECHANICAL ENGINEERS HANDBOOK, ELEVENTH REVISED EDITION ON POWER—*By Robert T. Kent, editor-in-chief, and 28 contributors. 1,254 pages, illustrated, 5⅝x8⅝ in. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. Price, $5.*

A revolutionary change has been made in the set-up of the famous "Kent" handbook. Its content is now divided into two sections, one dealing with the entire field of power and its applications, and the other covering present-day methods in design and shop practice.

This review deals solely with the Power volume, since the other one will not appear until 1937. The increased page size of the book permits the use of large, clear type, illustrations and diagrams, and enhances the practicality of the book.

There are seventeen sections in the Power volume as follows: Air; Water; Heat; Combustion and Fuels; Steam; Action of Steam in the Steam Boiler; Data concerning the Steam Engine; The Steam Turbine; Condensing and Cooling Equipment; Refrigeration and Ice Making; Heating, Ventilating and Air-Conditioning; Internal Combustion Engines; Transportation; Electric Power; Power Test Codes, Mathematical Tables.

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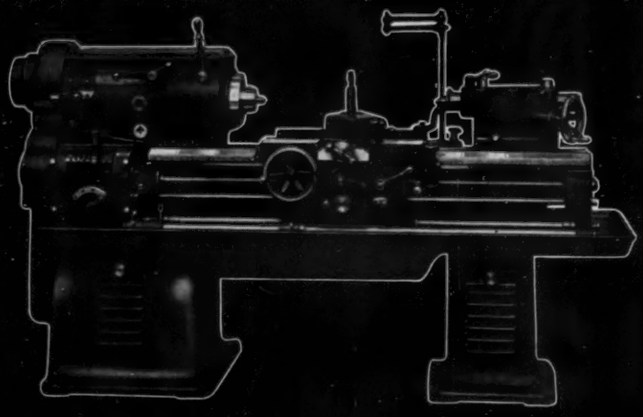
ENGINEERING QUESTIONS AND ANSWERS. VOL. I—*176 pages 7½x10 in. Published by Emmott & Co., Ltd., 28 Bedford St., London, W.C.2, England. Price 6 shillings.*

This volume is the outcome of a demand that the Questions and Answers Section of *Mechanical World*, an English publication, should be made into book form. This volum covers the answers of 1934 and 1935, and a projected second volume will continue from that point and carry on with the answers of 1936. It covers a good many problems that have arisen in connection with machine shop practice and also those in the power field.

The LeBLOND
TOOL ROOM LATHE



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